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PRELIMINARY HANDBOOK OF INSTRUCTIONS FOR RADIO TRANSMITTER T-465/ALT-7

This is preliminary data used for packaging with the equipment and is authorized for temporary use until official technical order handbooks become available.

Manufactured By
THE HALLICRAFTERS CO.
CHICAGO 24, ILLINOIS

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No. of Pages 122

PRELIMINARY
HANDBOOK OF INSTRUCTIONS
FOR
RADIO TRANSMITTER T-465/ALT-7

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TABLE OF CONTENTS

Section		Page
I	DESCRIPTION AND LEADING PARTICULARS	
	1-1. Purpose of Handbook	1-1
	1-3. Purpose of Equipment	1-1
	1-5. Tube and Fuse Complement	1-1
	1-7. Technical Characteristics	1-3
	1-9. Equipment Required But Not Supplied	1-5
II	INSTALLATION AND ADJUSTMENT	
	2-1. Unpacking and Checking New Equipment	2-1
	2-3. Cable Information	2-2
	2-5. Installation	2-2
III	OPERATION	
	3-1. Controls and Their Uses	3-1
	3-3. Preliminary Starting	3-8
	3-5. Starting and Operating Procedures	3-8
IV	THEORY OF OPERATION	
	4-1. General	4-1
	4-3. Block Diagram of Radio Transmitter T-465/ALT-7	4-1
	4-11. Noise Generator	4-5
	4-14. 1st and 2nd Video Amplifiers	4-5
	4-18. Modulator	4-9
	4-24. Oscillator	4-11
	4-30. Reflectometer	4-14

TABLE OF CONTENTS (cont)

Section			Page
	4-34.	Blanking Amplifier	4-20
	4-36.	Power Supply PP-506/APT-6	4-22
	4-39.	Meter Circuits	4-25
	4-42.	Control Circuits	4-28
V	MAINTENANCE		
	5-1.	Scope	5-1
	5-4.	Test Equipment	5-1
	5-6.	Special Tools	5-2
	5-8.	Fabrication of Cables for Test Bench Set Up	5-2
	5-10.	Test Bench Set Up	5-2
	5-12.	Preliminary Inspection	5-8
	5-14.	Minimum Performance Standards	5-10
	5-16.	Trouble Analysis	5-20
	5-18.	Voltage and Resistance Measurements	5-24
	5-20.	Installation of Oscillator Tubes in Radio Transmitter T-465/ALT-7	5-24
	5-22.	Installing Other Tubes in Radio Transmitter T-465/ALT-7	5-29
	5-26.	Setting Antenna Switch of Radio Transmitter T-465/ALT-7	5-29
	5-29.	Meter Calibration of Radio Transmitter T-465/ALT-7	5-31
	5-31.	Disassembly of Blower	5-34
	5-33.	Removal and Replacement of Sweep Motor	5-35

TABLE OF CONTENTS (cont)

Section		Page
	5-35. Cleaning of the Transmitter.....	5-37
	5-37. Rustproofing and Painting.....	5-38
VI	PARTS LIST	
VII	DIAGRAMS	
	7-1. General.....	7-1
	7-3. Index of Diagrams.....	7-1

LIST OF ILLUSTRATIONS

Figure No.	Title	Page
1-1	Radio Transmitter T-465/ALT-7	1-2
2-1	Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6, Cording Diagram	2-3
3-1	Radio Transmitter T-465/ALT-7, Controls and Connectors	3-5
3-2	Power Supply PP-506/APT-6, Controls and Connectors	3-7
4-1	Radio Transmitter T-465/ALT-7 and Power Supply PP-506/ALT-6, Block Diagram	4-2
4-2	Radio Transmitter T-465/ALT-7 Noise Generator, Simplified Diagram	4-6
4-3	Radio Transmitter T-465/ALT-7 Video Amplifiers, Simplified Diagram	4-7
4-4	Radio Transmitter T-465/ALT-7 Modulator and Oscillator, Simplified Diagram	4-10
4-5	Reflectometer, Functional Diagram	4-15
4-6	Schematic Diagram of Typical Reflectometer	4-19
4-7	Radio Transmitter T-465/ALT-7 Blanking Amplifier, Simplified Diagram	4-21
4-8	Power Supply PP-506/APT-6 Low Voltage Rectifier, Simplified Diagram	4-23
4-9	Power Supply PP-506/APT-6 High Voltage Rectifier, Simplified Diagram	4-24
4-10	Meter Circuits, Simplified Diagram	4-26
5-1	Antenna Cable	5-3
5-2	Power Cable	5-4
5-3	High Voltage Cable	5-5
5-4	Low Voltage and Control Cable	5-6

LIST OF ILLUSTRATIONS (cont)

Figure No.	Title	Page
5-5	Test Bench Set-Up	5-7
5-6	Radio Transmitter T-465/ALT-7, Removal of Oscillator Tubes	5-25
5-7	Radio Transmitter T-465/ALT-7, Tube Location	5-30
5-8	Radio Transmitter T-465/ALT-7, Antenna Switch Adjustment	5-32
5-9	Radio Transmitter T-465/ALT-7, Showing Removal of the Sweep Unit	5-36
7-1	Radio Transmitter T-465/ALT-7, Bias and B+ Voltage Distribution	7-2
7-2	Control Circuits	7-3
7-3	Radio Transmitter T-465/ALT-7, Top View	7-4
7-4	Radio Transmitter T-465/ALT-7, Inside Front Panel	7-5
7-5	Radio Transmitter T-465/ALT-7, Bottom View	7-6
7-6	Radio Transmitter T-465/ALT-7, Left Side	7-7
7-7	Radio Transmitter T-465/ALT-7, Right Side Oscillator Removed	7-8
7-8	Radio Transmitter T-465/ALT-7, Rear View	7-9
7-9	Radio Transmitter T-465/ALT-7, Oscillator Oblique Views	7-10
7-10	Sweep Motor Speed Regulator	7-11
7-11	Radio Transmitter T-465/ALT-7, Schematic Diagram	7-13
7-12	Power Supply PP-506/APT-6, Schematic Diagram	7-15

LIST OF TABLES

Table	Title	Page
I	Tube Complement	1-3
II	Fuse Complement	1-3
III	Technical Characteristics of Radio Transmitter T-465/ALT-7	1-3
IV	Equipment Required But Not Supplied	1-5
V	Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6 Cable Assembly Information	2-4
VI	Radio Transmitter T-465/ALT-7 Controls and Connectors	3-1
VII	Power Supply PP-506/APT-6, Controls and Connectors	3-6
VIII	Test Equipment Required	5-1
IX	Preliminary Inspection	5-8
X	Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6 Trouble Analysis	5-20
XI	Radio Transmitter T-465/ALT-7, Resistance Measurements	5-26
XII	Radio Transmitter T-465/ALT-7, Voltage Measurements	5-27
XIII	Power Supply PP-506/APT-6, Resistance Measurements	5-28
XIV	Power Supply PP-506/APT-6, Voltage Measurements	5-28

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. PURPOSE OF HANDBOOK.

1-2. This handbook contains information concerning the description, installation, operation, theory of operation, and maintenance of Radio Transmitter T-465/ALT-7; manufactured by The Hallicrafters Company, Chicago, Illinois.

1-3. PURPOSE OF EQUIPMENT.

1-4. Radio Transmitter T-465/ALT-7 is specifically designed as airborne ECM (electronic countermeasure) equipment for jamming enemy radar facilities. Enemy AM or FM equipment operating within the range of 168 to 352 mc (megacycles) can be jammed. The r-f output of the transmitter may be either cw, AM, or FM, depending upon the setting of the front panel controls. The range of frequencies swept is approximately 7 percent of the carrier frequency at the low end, and 10 percent at the high end of the band at a selectable rate between 8 and 400 cycles per second. Circuits are provided which may be used to noise modulate the r-f output signal. Provision is also made for receiving a blanking pulse to disable the transmitter for "look thru" operation. Figure 1-1 shows the transmitter as supplied by the manufacturer.

1-5. TUBE AND FUSE COMPLEMENT.

1-6. The tube and fuse complement of the transmitter are given in Tables I and II. Table I lists the tubes and Table II lists the fuses.

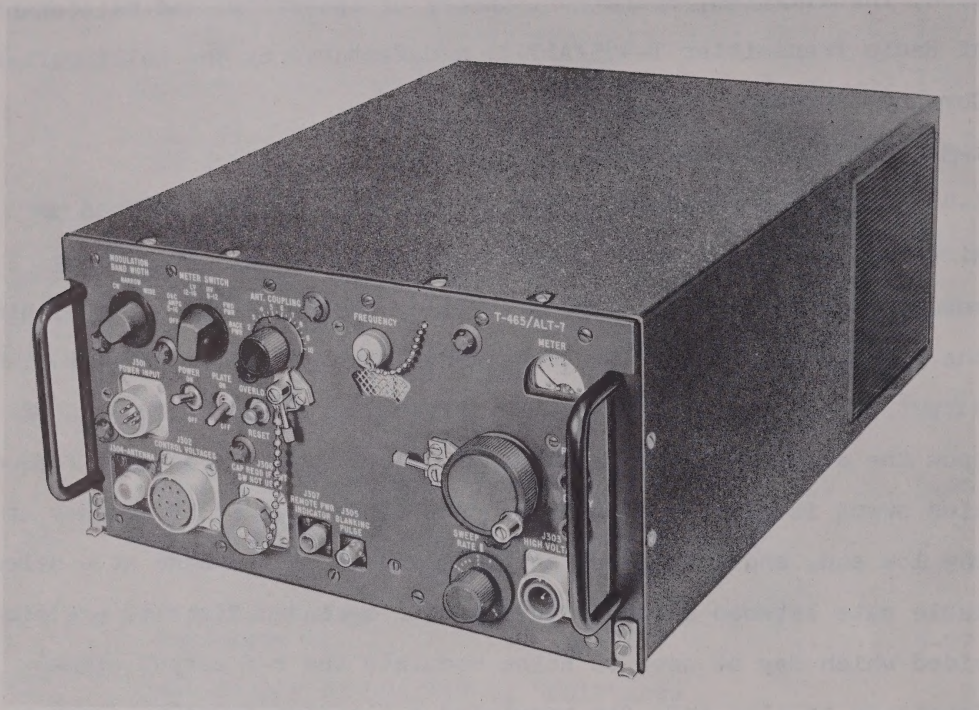

Figure 1-1. Radio Transmitter T-465/ALT-7.

TABLE I. TUBE COMPLEMENT

Equipment	Reference Symbol	Jan Type Tube Designation	Stage
Radio Transmitter T-465/ALT-7	V301	6161	R-f oscillator
	V302	6161	R-f oscillator
	V303	6D4	Noise generator
	V304	6AU6	Video amplifier
	V305	6AU6	Video amplifier
	V306	6AS7G	Modulator
	V307	6AQ5/6005	Blanking amplifier
	V308	2D21	Sweep motor speed regulator
	V309	2D21	Sweep motor speed regulator

TABLE II. FUSE COMPLEMENT

Equipment	Fuse	Rating (amp)	Location
Radio Transmitter T-465/ALT-7	F301	2A	Primary of filament Transformer T301
	F302	10A	24V D-C line

1-7. TECHNICAL CHARACTERISTICS.

1-8. The technical characteristics of Radio Transmitter T-465/ALT-7 are listed in Table III.

TABLE III. TECHNICAL CHARACTERISTICS OF RADIO TRANSMITTER T-465/ALT-7

Frequency range	168 to 352 mc in one continuous band.
Type of signal	
Cw	168 to 352 mc in one continuous band. This signal may be noise modulated.
FM	Swept through a band of frequencies equal to approximately 7% of the frequency at the low end, and 10% at the high end of the band at a selectable sweep rate between 8 and 400 cps. This signal may be noise modulated.

TABLE III. TECHNICAL CHARACTERISTICS OF RADIO TRANSMITTER T-465/ALT-7 (cont)

Power Output	
Cw	100 watts minimum at any frequency within specified range.
Noise modulated cw	100 watts minimum at any frequency within specified range.
Modulation bandwidth	Increases gradually with increase in frequency; 0.1 to 0.5 mcs at NARROW position of MODULATION BANDWIDTH switch and 0.5 to 2 mc at WIDE position of switch.
Output impedance	50 ohms into coaxial cable.
Number of tubes	9
Power required for transmitter and power supply:	
Ac	1300 volt-amperes.
Dc	100 watts.
Power source requirements:	
Ac	115 volts, 400 cps, 1 phase, at 11 amps.
*Ac	115 volts, regulated 400 cps, 10 volt-amperes (sweep motor).
Dc	28 volts with a range of 24 to 29 volts, at 6 amps.
Weight	54 pounds.
Dimensions:	
Height	7-3/4 in.
Depth	21-1/2 in.
Width	15-1/4 in.

* Use auxiliary frequency-regulated power source (400 cps ±5%) in addition to the primary a-c source if the frequency of the primary a-c source is not regulated.

1-9. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-10. Table IV lists the equipment required but not supplied for this installation. The name of the unit required, quantity, type designation, required characteristics, and function are given.

TABLE IV. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	Name of Unit	Type Designation	Required Characteristics	Function
1	A-c power		115 volts, 380 to 1000 cps, single phase; 1300 volt amperes output in excess of other aircraft power requirements.	A-c power source for transmitter and power supply.
1	A-c power		115 volts, 400 cps regulated 10 volt-amperes minimum.	Use if main AC supply is UNREGULATED (sweep motor).
1	D-c power		28 volts d-c; 100 watts output in excess of other aircraft power requirements.	D-c power source for transmitter and power supply.
2	Antenna switching relay		Capable of switching r-f output to one antenna or the other.	Used in conjunction with transfer switch in the transmitters. Transfers r-f output of transmitter from one antenna to the other.

TABLE IV. EQUIPMENT REQUIRED BUT NOT SUPPLIED (cont)

Quantity	Name of Unit	Type Designation	Required Characteristics	Function
1	Antenna		Capable of transmitting frequencies on lower half of 168 to 352 mc band; 50 ohm impedance.	
1	Antenna		Capable of transmitting frequencies on upper half of 168 to 352 mc band; 50 ohm impedance.	
1	Mounting base	MT-C1-D MT-C2-D		Mounting base for Transmitter T-465/ALT-7.
1	Mounting base	MT-B1-D2 MT-B2-D2		Mounting base for Power Supply PP-506/APT-6.
1	R-f output transmission cable.	RG-14A/U	50 ohm	Connects between transmitter ANTENNA receptacle and receptacle on antenna switch actuator.
1	Power input cable.			Connects between transmitter POWER INPUT receptacle and aircraft power source.

TABLE IV. EQUIPMENT REQUIRED BUT NOT SUPPLIED (cont)

Quantity	Name of Unit	Type Designation	Required Characteristics	Function
1	Control Cable			Connects between transmitter CONTROL VOLTAGES receptacle and power supply CONTROL receptacle.
1	Antenna switch cable			Connects between transmitter CAP REQ'D IF AMT SW NOT USED receptacle and receptacle on antenna switch actuator.
1	Blanking pulse cable			Connects between transmitter BLANKING PULSE receptacle and pulse output receptacle on Pulse Generator O-207/ALA-7 or equivalent.
1	External power indicator			Connects between transmitter EXTERNAL PWR INDICATOR receptacle and external power meter receptacle.

TABLE IV. EQUIPMENT REQUIRED BUT NOT SUPPLIED (cont)

Quantity	Name of Unit	Type Designation	Required Characteristics	Function
1	High voltage cable			Connects between Transmitter HIGH VOLTAGE receptacle and power supply HIGH VOLT. receptacle.
1	Power Supply PP-506/APT-6		900 volts d-c and necessary control circuits to operate the transmitter	Furnishes the high voltage and necessary control circuits to operate the transmitter.
1	Blanking Pulse Generator	O-207/ALA-7	+40 volts dc output.	Furnishes blanking pulse necessary for look-through operation.

SECTION II

INSTALLATION AND ADJUSTMENT

2-1. UNPACKING AND CHECKING NEW EQUIPMENT.

2-2. The transmitter is packed with the tubes installed and should be ready for installation unless the equipment has been damaged in shipment. After the transmitter is received, unpack it and remove all silica gel immediately. Then, to insure proper operation make the following checks.

a. Examine the transmitter for evidence of damage in shipment such as dents, bent handles, and broken receptacles or knobs. Examine any damage carefully to determine its possible effect on the operation of the unit.

b. Unscrew the machine screws which secure the front of the cabinet to the chassis. At the rear of the unit, turn the Simmons fastener a half turn counterclockwise, releasing the chassis from the cabinet. Remove the chassis from the cabinet. Carefully inspect the glass, steatite, Teflon, and mycalex parts mounted on the chassis. These parts are brittle and may be damaged during shipment.

c. Clean and dry the equipment if moisture or corrosion is evident.

d. Check the tightness of all spring clamps such as tube cap connectors, tube sockets, and fuse clips.

e. Check for missing or loose screws.

f. Install the equipment in the test bench set-up (par. 5-10) and check the performance of the equipment (par. 5-14).

g. Check the antenna switch adjustment (par. 5-26).

2-3. CABLE INFORMATION.

2-4. The cables necessary for installing the transmitter must be cut and assembled to suit the particular installation. This normally is done by the aircraft manufacturer. If such fabrication must be done by the using organization for Radio Transmitter T-465/ALT-7, cut and assemble the cables as given in the cable fabrication instructions for the test bench. The cording diagram of Radio Transmitter T-465/ALT-7 and the power supply is given in figure 2-1. Table V gives the cable assembly information.

2-5. INSTALLATION.

2-6. The transmitter should be located in the airplane so that the r-f transmission line to the antennas is as short as possible. Power necessary to operate the transmitter must be available. Locate the equipment so that the front panels are easily accessible to the operator. Bolt the mounting base, if it is not already mounted, in position and make all ground connections. If the shock mounts are fastened to a metal surface, bend each ground strap so that they can be fastened under one of the four bolts which hold the rubber buttons of the shock mount. If the mounts are fastened to an insulating material, extend the ground leads to the nearest metal which is a part of the carrier. Slide each unit into place and tighten the clamp screws on the front of the mounting base over the hooks on the bottom of the unit. Fasten the clamp screws to the frame of the mounting base by threading safety wires through the holes provided.

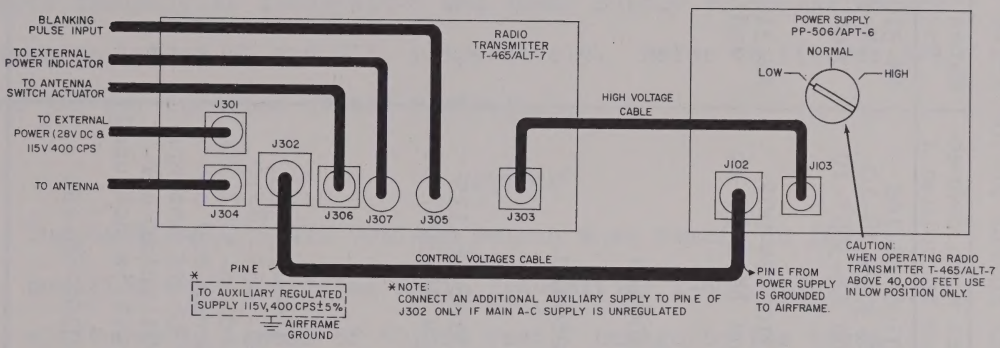

Figure 2-1. Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6, Cording Diagram.

TABLE V. TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6 CABLE ASSEMBLY INFORMATION

From Transmitter Connector	To	Mates with connector in column 1	Mates with connector in column 2	Cable or wire
HIGH VOLTAGE J303 AN-3102A-18-16P	Power Supply: HIGH VOLT. P103 AN-3102-18-16S	AN-3106-18-16S AN-3055-18-10 and AN-3057-10	AN-3106-18-16P, AN-3055-18-10 and AN-3057-10	
CONTROL VOLTAGES J302 AN-3102-24-20S	Power Supply: CONTROL P102 AN-3102A-24-20P	AN-3106-24-20P and AN-3057-16	AN-3106-24-20S and AN-3057-16	
ANTENNA J304 UG-101A/U	Antenna switching relay	UG-100A/U		RG-14/U
BLANKING PULSE J305 UG-262A/U	Blanking pulse voltage source	UG-260A/U		RG-14/U
POWER INPUT J301 AN-3102-18-11P	28 volts d-c and 115 volts, 380 to 1000 cps a-c power source	AN-3106-18-11S and AN-3057-10		
CAP REQ'D IF ANT SW NOT USED J306 AN-3102A-18-12P	Antenna switching control source	AN-3106-18-12S, AN-3055-18-10 and AN-3057-10. Screw cap on J306 if antenna switching circuit is not used.		
REMOTE PWR INDICATOR J307	Remote power indicator	AN-3106-8S-1S		

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SECTION III

OPERATION

3-1. CONTROLS AND THEIR USE.

3-2. All operating controls are located on the front panel of the transmitter with the exception of the OSCILLATOR PLATE VOLTAGE switch which is located on the front panel of Power Supply PP-506/APT-6. The function of the front panel controls and connectors of Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6 are given in tables VI and VII, respectively. Refer to figures 3-1 and 3-2 for location of all controls.

CAUTION

The OSCILLATOR PLATE VOLTAGE switch must remain in LOW position when operating Radio Transmitter T-465/ALT-7 at altitudes in excess of 40,000 feet. Damage to the transmitter will result if the switch is placed in positions other than LOW.

TABLE VI. RADIO TRANSMITTER T-465/ALT-7 CONTROLS AND CONNECTORS

Index No.	Control Marking	Function of Control	Reference Symbol
1	ANTENNA receptacle	Receives antenna transmission line coaxial.	J304
2	CONTROL VOLTAGES receptacle	Receives control and low-voltage cable from power supply.	J302
3	BLANKING PULSE receptacle	Receives cable delivering oscillator blanking pulse.	J305

TABLE VI. RADIO TRANSMITTER T-465/ALT-7 CONTROLS AND CONNECTORS (cont)

Index No.	Control Marking	Function of Control	Reference Symbol
4	HIGH VOLTAGE receptacle	Receives oscillator plate voltage supply cable from the power supply.	J303
5	REMOTE PWR INDICATOR receptacle	Receives cable from remote power indicator.	J307
6	CAP REQ'D IF AN SW NOT USED receptacle	Receives control cable for antenna switching relay (if used).	J306
7	POWER INPUT receptacle	Receives cable supplying 28 volts d-c, 115 volts 380 to 1000 cps a-c, and regulated a-c supply if necessary from aircraft power supply.	J301
8	POWER ON-OFF switch	Controls application of a-c power to filament transformers and d-c power to the blower and control circuits of the radar set.	S305
9	PLATE ON-OFF switch	Energizes h-v power supply and applies h-v to plates of oscillator tubes.	S303
10	METER SWITCH	Selects circuits for specific measurements by the meter:	S306
	OFF	Meter out of circuits.	
	OSC AMPS	Plate current of oscillator tubes V301 and V302.	
	LV 12-16	Low voltage power supply.	

TABLE VI. RADIO TRANSMITTER T-465/ALT-7 CONTROLS AND CONNECTORS (cont)

Index No.	Control Marking	Function of Control	Reference Symbol
	HV 8-12	High voltage power supply.	
	FWD PWR	Incident power into transmission line.	
	BACK PWR	Reflected power from transmission line.	
11	MODULATION BANDWIDTH	Selects mode of operation of the radar set.	S307
	CW	Removes B+ voltage from tubes V303 through V306. Output of transmitter is a continuous wave.	
	NARROW	Supplies B+ voltage to tubes V303 through V306. Output is modulated by a narrow range of frequencies.	
	WIDE	Wide-band noise modulation.	
12	ANT. COUPLING control	Varies coupling of transmitter tank circuit to transmission line.	C324
13	OVERLOAD RESET switch	Re-applies h-v supply after the overload conditions have been relieved.	S304
14	TIME DELAY pilot lamp (green)	Indicates when plate voltage may be applied.	I302
15	FREQUENCY	For continuous adjustment of transmitter output frequency from 168 to 352 mc.	

TABLE VI. RADIO TRANSMITTER T-465/ALT-7 CONTROLS AND CONNECTORS (cont)

Index No.	Control Marking	Function of Control	Reference Symbol
16	PLATE pilot lamp (red)	Indicates when h-v has been supplied to the plates of oscillator tubes V301 and V302.	I301
17	METER	Measures OSC AMPS. low voltage, high voltage, and standing wave ratio of transmission line depending on the position of METER SWITCH.	M301
18	ANTENNA switch Actuator adj.	Permits antenna switching device to be preset to the desired switching frequency.	S315
	PANEL lamps	For illumination of panel controls and markings.	I303 thru I309
19	SWEEP RATE control		
	OFF	In the OFF position A-C voltage is disconnected from the sweep motor.	
	LOW	In the lowest position the sweep rate is 8 cps.	
	HIGH	In the highest position the sweep rate is 400 cps.	
20	Regulated-unregulated switch	When regulated power is available, switch is placed in regulated position. In the unregulated position switch allows regulated power to be applied to the sweep motor speed regulator.	S308

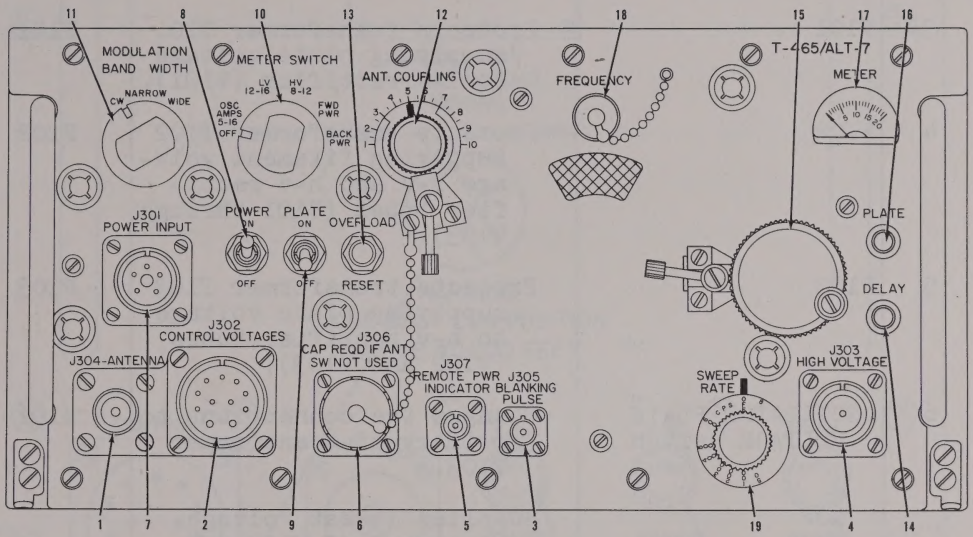


Figure 3-1. Radio Transmitter T-465/ALT-7 Controls and Connectors.

TABLE VII. POWER SUPPLY PP-506/APT-6 CONTROLS

Index No.	Control Marking	Function of Control	Reference Symbol
1	CONTROL, receptacle	Receives power and control voltage cable from transmitter.	J102
2	HIGH VOLT. receptacle	Connects high voltage cable from transmitter.	J103
3	F101	Protects transformer T101 supplying plate voltage to 1-v rectifier (V101).	F101
4	F102	Protects transformer T102 supplying filament voltage 1-v and h-v rectifier tubes (V101 through V103).	F102
5	F103	Protects transformer T103 supplying plate voltage to h-v rectifier tubes (V102 and V103).	F103
6	OSCILLATOR PLATE VOLTAGE switch	Changes the connections to primary of transformer T103.	S101
	LOW	Supplies lowest voltage to plates of V102 and V103.	
	NORMAL	Use in LOW position only when above 40,000 ft.	
	HIGH	Use in LOW position only when above 40,000 ft.	
7	SPARE	Spare fuse for F101.	
8	SPARE	Spare fuse for F102.	
9	SPARE	Spare fuse for F103.	

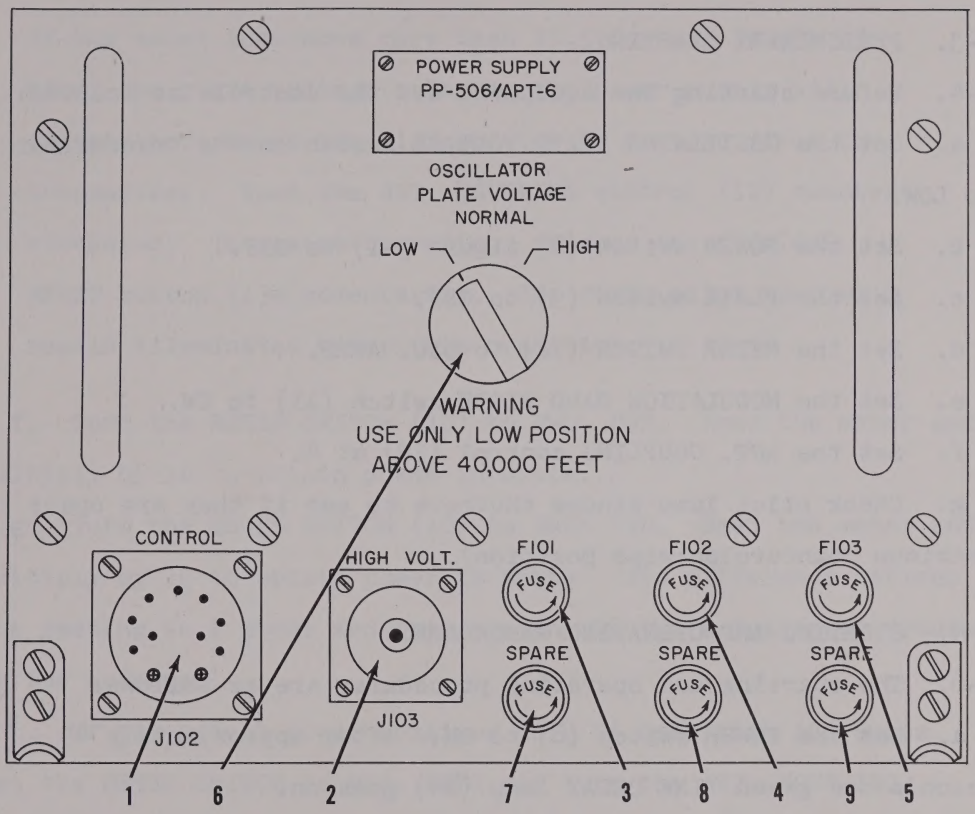


Figure 3-2. Power Supply PP-506/APT-6, Controls and Connectors.

NOTE

When operating Radio Transmitter T-465/ALT-7 above 40,000 feet, place the OSCILLATOR PLATE VOLTAGE switch on the power supply in the LOW position.

3-3. PRELIMINARY STARTING.

3-4. Before starting the equipment set the controls as follows:

a. Set the OSCILLATOR PLATE VOLTAGE switch on the transmitter to LOW.

b. Set the POWER switch (8, figure 3-1) to OFF.

c. Set the PLATE switch (9) to OFF.

d. Set the METER SWITCH (10) to OSC. AMPS.

e. Set the MODULATION BAND WIDTH switch (11) to CW.

f. Set the ANT. COUPLING control (12) at 4.

g. Check pilot lamp window shutters to see if they are open; (maximum counterclockwise position).

3-5. STARTING AND OPERATING PROCEDURES.

3-6. The starting and operating procedures are as follows:

a. Set the POWER switch (8) to ON. After approximately 45 seconds the green TIME DELAY lamp (14) goes on.

b. Depress the OVERLOAD RESET switch (13) momentarily.

c. Set the FREQUENCY control (15) to the desired frequency. Turn the handle on the locking device clockwise to lock the control in place.

d. Set the PLATE switch (9) to ON. The red PLATE lamp (16) illuminates.

e. Observe the METER (17). If the METER indicates more than 16, turn the ANT. COUPLING control (12) counterclockwise until it indicates 16.

NOTE

If the meter indicates more than 17.5 for any length of time, the plate voltage relay in the power supply will operate and remove the high and low B+ voltages from the transmitter. Turn the ANT. COUPLING control (12) counterclockwise. To resume operation, depress the OVERLOAD RESET button (13) momentarily. The PLATE pilot lamp will remain illuminated under this condition.

f. Turn the METER SWITCH (10) to FWD. PWR. Read the meter and multiply by 10 to obtain power in watts.

g. Turn the METER SWITCH (10) to BACK PWR. Read the meter and multiply by 10 to obtain power in watts. The difference between the reading in f above and this reading is the actual power radiated by the antenna.

h. If the actual power obtained in g is less than 100 watts, set the METER SWITCH to OSC. AMPS and turn the ANT. COUPLING control clockwise a small amount.

i. Repeat the steps indicated in f, g, and h above, until the actual power radiated by the antenna is a minimum of 100 watts. The equipment is now tuned for cw operation. If noise modulation is desired proceed with step j below.

j. Set the MODULATION BANDWIDTH switch (11) to NARROW or WIDE depending on the tactical situation.

k. Perform steps f and g.

l. If the actual power is not in the range of 90 to 100 watts, set the METER SWITCH in the OSC. AMPS position and set the ANT. COUPLING control to the position which gives an actual power output in the range.

m. When the necessary power is obtained lock the ANT. COUPLING control in place by turning the handle of the locking device clockwise.

n. Return the METER SWITCH to OSC. AMPS. It should be left in this position during operation.

o. If an FM type signal is desired, turn the SWEEP RATE control (20) on and set it to the position which gives the desired sweep rate.

p. The rf output of the transmitter may now be monitored with a communications receiver to determine if it has been adjusted for the desired type or rf output signal.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. This section discusses the theory of Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6. The theory of each stage is discussed in the order of signal or operation sequence wherever possible. Paragraphs 4-3 through 4-35 cover Radio Transmitter T-465/ALT-7, and paragraphs 4-36 through 4-38 cover Power Supply PP-506/APT-6. The meter circuits and control circuits are discussed in paragraphs 4-39 and 4-42, respectively.

4-3. BLOCK DIAGRAM OF RADIO TRANSMITTER T-465/ALT-7.

4-4. GENERAL. Radio Transmitter T-465/ALT-7 operates in the frequency range of 168 to 352 mc. The transmitter is capable of generating a CW or FM output. Narrow or wide band noise modulation with either type of output signal is possible. To jam enemy radar networks, cw and noise modulated cw are used. A provision is incorporated for disabling the transmitter in order to view jammed signals of enemy stations. The signal being jammed may be viewed on the panoramic indicator tube of a panoramic receiver. Figure 4-1 shows a block diagram of Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6.

4-5. NOISE GENERATOR V303. The noise generator V303 generates the random noises which are used to modulate the oscillator. The circuit uses a type 6D4 thyratron tube. A magnet, which surrounds

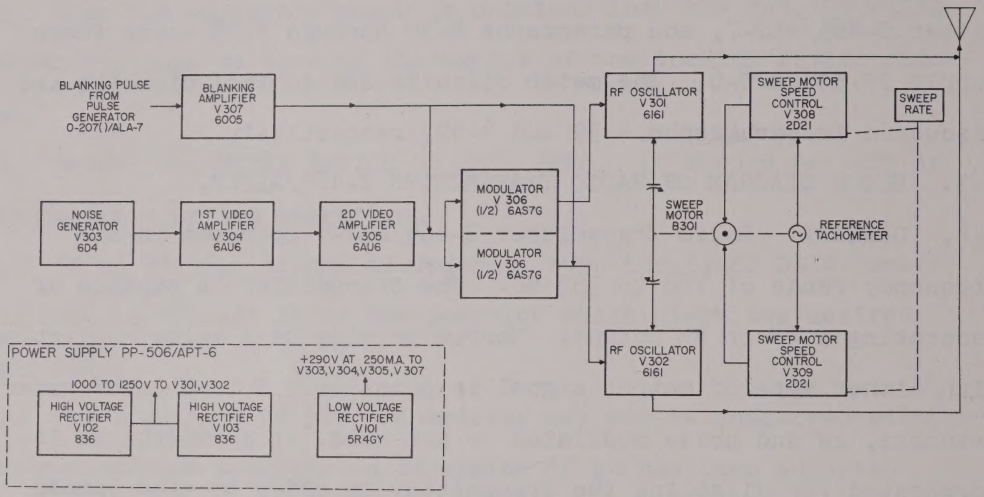

BLANKING PULSE FROM PULSE GENERATOR 0-207( )/ALA-7
BLANKING AMPLIFIER V 307 6005
NOISE GENERATOR V 303 6D4
1ST VIDEO AMPLIFIER V 304 6AU6
2D VIDEO AMPLIFIER V 305 6AU6
MODULATOR V 306 (1/2) 6AS7G
MODULATOR V 306 (1/2) 6AS7G
RF OSCILLATOR V 301 6161
RF OSCILLATOR V 302 6161
SWEEP MOTOR SPEED CONTROL V 308 2D21
SWEEP RATE
SWEEP MOTOR B 301
REFERENCE TACHOMETER
SWEEP MOTOR SPEED CONTROL V 309 2D21
POWER SUPPLY PP-506/APT-6
1000 TO 1250 V TO V 301, V 302
+290 V AT 250 M A TO V 303, V 304, V 305, V 307
HIGH VOLTAGE RECTIFIER V 102 836
HIGH VOLTAGE RECTIFIER V 103 836
LOW VOLTAGE RECTIFIER V 101 5R4GY

Figure 4-1. Radio Transmitter T-465/ALT-7 and Power Supply PP-506/APT-6, Block Diagram.

the tube, assists in developing the random noise output. The output of the noise generator is fed to video amplifier V304.

4-6. VIDEO AMPLIFIER STAGES V304 and V305. Two stages of amplification are needed to bring the amplitude of the random noise to a sufficient level. Two type 6AU6 tubes are used in these stages. As the random noise passes through two stages of amplification, the noise peaks are strongly clipped. The output of 2nd video amplifier V305 is fed to the input circuits of modulator V306. B+ is removed from the noise generator and video amplifier stages when the transmitter is operated on cw.

4-7. MODULATOR V306. The output of the modulator is used to grid modulate the oscillator stage. A type 6AS7G tube is used in this circuit. Either narrow or wide band modulation may be obtained by setting the MODULATION BANDWIDTH switch to the desired position. A positive blanking pulse from a pulse generator such as Pulse Generator O-207/ALA-7, may be applied to blanking amplifier V307. A negative voltage output of the blanking amplifier is then applied to the modulator, to disable the transmitter. The blanking pulse is synchronized with a panoramic indicator receiver. This enables the operator to view the enemy radar or communication signal being jammed.

4-8. OSCILLATORS V301 and V302. The r-f oscillator uses two type 6161 tubes connected in a tuned plate, tuned cathode, push-pull circuit. The oscillator is capable of delivering a minimum power output in cw operation of 100 watts throughout the frequency range

of the transmitter. A minimum power output of 100 watts is obtained in modulated cw operation. The r-f output of the oscillator is fed to one of two antennas. One antenna is used on the low end of the band and another antenna is used on the high end of the band. A switching device, which is controlled by the oscillator tuning dial, switches antennas at a designated frequency.

4-9. BLANKING AMPLIFIER V307. Blanking amplifier V307 is used to disable the transmitter. When a blanking pulse is applied to the blanking amplifier, a negative voltage output is applied to the grids of modulator tube V306. This disables the modulator and oscillator of the transmitter. The blanking pulse applied to the input of the pulse amplifier is synchronized with the time trace of a panoramic indicator tube on a panoramic indicator receiver. This enables the operator to view the enemy radar or communication signal being jammed. The signal appears on the portion of the panoramic indicator display tube time trace which corresponds to the time the transmitter is disabled. The blanking amplifier uses a type 6AQ5/6005 tube.

4-10. SWEEP MOTOR SPEED REGULATORS V308 and V309. The speed regulators determine the amplitude of voltage applied to the sweep motor. Two type 2D21 thyratrons are used in this stage. The bias on V308 and V309 is determined by SWEEP RATE control R325 and the feedback from the motor tachometer. The bias determines the firing point of the thyratrons, which in turn determines the speed at which the sweep motor rotates capacitor C360.

4-11. NOISE GENERATOR.

4-12. The signal output of noise generator V303 is a random noise. This random noise is amplified by video amplifiers V304 and V305 and used to modulate the r-f output of the transmitter. Figure 4-2 is a simplified diagram of the noise generator. A type 6D4 gas triode tube is used. It fires continuously and has a comparatively low, constant d-c voltage drop between plate and cathode. The frequency characteristics of the noise generator is affected by the ionization time of the tube to the extent that at frequencies above one megacycle the amplitude falls off rapidly. The presence of a magnetic field, produced by a small permanent magnet, gives a more uniform frequency characteristic (and has the added feature that it prevents a "blocking" condition which is frequently troublesome in gas tube circuits).

4-13. The random noise of V303 is developed across plate load resistor R305. The signal is then coupled to the grid of the first video amplifier V304. B+ is applied to the noise generator through resistor R316. Capacitor C334 bypasses rf to ground.

4-14. FIRST AND SECOND VIDEO AMPLIFIERS.

4-15. Two video amplifiers are used to amplify the random noise. Two pentode type 6AU6 tubes are used (see figure 4-3). The random noise from noise generator V303 is fed to the grid of the first video amplifier V304 through coupling capacitor C331. The random noise is developed across plate load resistor R308 and inductance L304 which are connected in parallel. From the plate of the first video amplifier the random noise is coupled to the

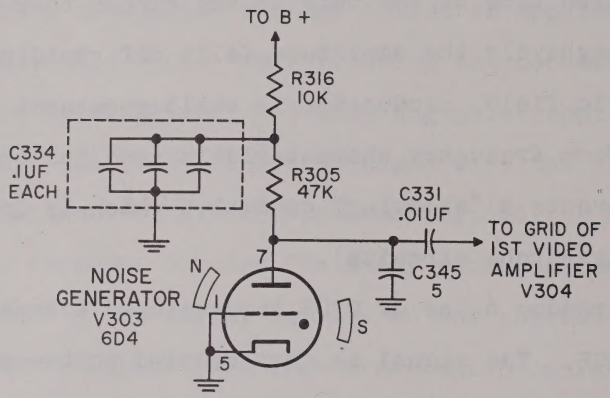


Figure 4-2. Radio Transmitter T-465/ALT-7 Noise Generator, Simplified Diagram.

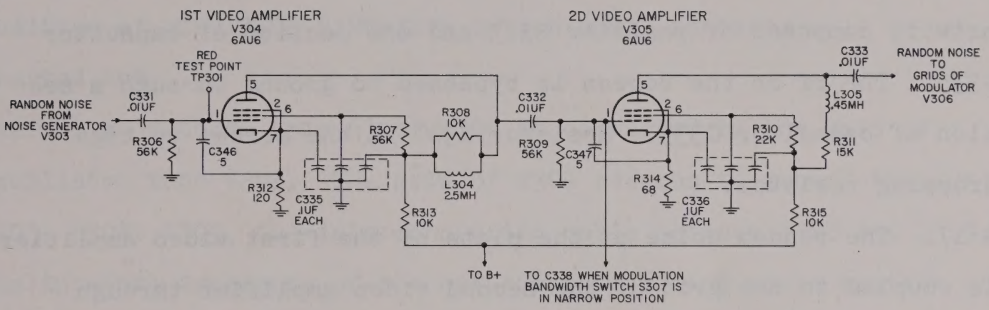


Figure 4-3. Radio Transmitter T-465/ALT-7 Video Amplifiers, Simplified Diagram.

grid of the second video amplifier through coupling capacitor C332. The second video amplifier further amplifies the noise and develops it across plate load inductance L305 and resistor R311. The noise is then coupled to the grids of the modulator through coupling capacitor C333.

4-16. Resistor R306 is the grid load resistor for first video amplifier which is bypassed by capacitor C346. The amplifier biased by cathode resistor R312 and one section of capacitor C335. Screen and plate voltages are obtained through a decoupling network composed of resistor R313 and one section of capacitor C335. The rf on the screen is bypassed to ground through a section of capacitor C335. Resistor R307 is the screen voltage dropping resistor.

4-17. The random noise at the plate of the first video amplifier is coupled to the grid of the second video amplifier through coupling capacitor C332. It is developed across grid load resistor R309 which is bypassed by capacitor C347. Cathode bias is supplied by cathode dropping resistor R314 which is bypassed by one section of capacitor C336. Another section of capacitor C336 bypasses the rf on the screen. Screen voltage is obtained through screen dropping resistor R310. Resistor R315 and a section of capacitor C336 form a decoupling network which keeps rf from entering the B+ supply circuits.

4-18. MODULATOR.

4-19. Modulator V306 grid modulates the r-f output of the oscillator with the random noise it receives from the second video amplifier (see figure 4-4). The modulator uses a dual triode type tube.

4-20. Resistors R320 and R322 are the grid load resistors. Capacitors C348 and C349 are r-f bypass capacitors for the grids of the modulator. The plates are paralleled and are connected to ground through resistors R317 and R321. In the NARROW and WIDE position of MODULATOR BANDWIDTH switch S307, resistor R317 is shorted out.

4-21. One cathode (pin 6) of V306 is connected to the grid of oscillator tube V301. The grid of V301 returns to ground through L303, R304, L309, the interconnecting cable between J308 and J310, the internal impedance of the cathode (pin 6) and plate section of V306, resistors R317 and R321. The conventional oscillator grid leak for V301 has been replaced by the internal impedance of this section of the modulator. The grid of V302 returns to ground through L302, R303, L310, the interconnecting cable between J313 and J309, the internal impedance of the cathode (pin 3) and plate section of V306, resistors R317 and R321. The conventional grid leak for V301 has been replaced by the internal impedance of this section of the modulator. The oscillator grid voltage developed by the oscillation of the oscillator tubes appears across the cathode to plate resistance of each section of the modulator.

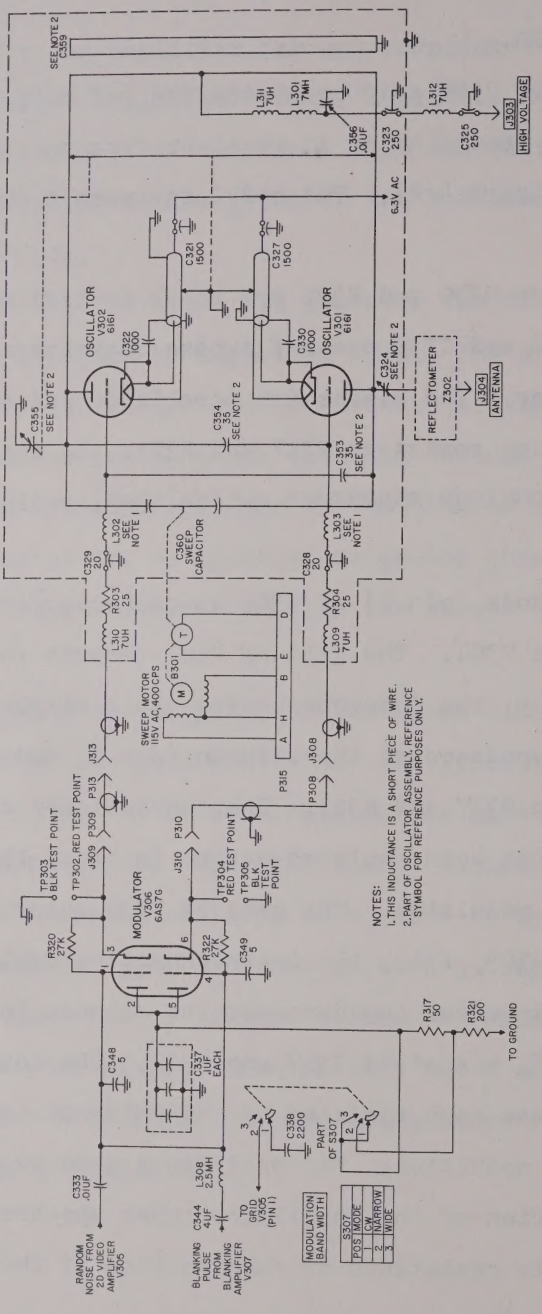

OSCILLATOR V302 6161
OSCILLATOR V301 6161
MODULATOR V306 6AS7G
SWEEP MOTOR 115V AC, 400 CPS B301
REFLECTOMETER Z302
J3303 HIGH VOLTAGE
J3304 ANTENNA
6.3V AC
TP303 BLK TEST POINT
TP302 RED TEST POINT
TP304 RED TEST POINT
TP305 BLK TEST POINT
RANDOM NOISE FROM 2D VIDEO AMPLIFIER V305
BLANKING PULSE 4 μF FROM BLANKING AMPLIFIER V307
TO GRID V306 (PIN 1)
TO GROUND
MODULATION BAND WIDTH
S307 POS MODE 1 CW 2 NARROW 3 WIDE
NOTES:
1. THIS INDUCTANCE IS A SHORT PIECE OF WIRE.
2. PART OF OSCILLATOR ASSEMBLY. REFERENCE SYMBOL FOR REFERENCE PURPOSES ONLY.

Figure 4-4. Radio Transmitter T-465/ALT-7 Modulator and Oscillator, Simplified Diagram.

4-22. Applying the amplified random frequencies from the output of the second video amplifier to the grids of the modulator causes the internal impedance of each section of V306 to vary accordingly. With the MODULATION BANDWIDTH switch in the cw position, no random signals are applied to the modulator grids and the two sections of the modulator serve only as d-c returns for the grids of the oscillator tubes. With the switch in the WIDE or NARROW position, random signals are applied to the modulator grids and the average impedance of each section increases because grid modulation of the oscillator produces downward amplitude modulation. Short circuiting resistor R317 by one section of S307 in the WIDE or NARROW position provides some compensation for this downward amplitude modulation. The apparent difference between average modulated power output and cw power output is reduced by this compensation.

4-23. When blanking amplifier V307 is used the modulator will be cut off with the oscillator during the time of the blanking pulse. This is due to the negative pulse which is coupled to the grids of the modulator through coupling capacitor C344 and inductance L308.

4-24. OSCILLATOR.

4-25. The oscillator consists of two type 6161 triode tubes (see figure 4-4) connected in a push pull arrangement. The frequency can be tuned continuously over the range of 168 to 352 mc. V301 and V302 are external anode, air cooled tubes with a nominal dissipation rating of 250 watts. The tank circuit for this push pull oscillator is a flat plate type transmission line. The tubes are physically inserted into it, and are so arranged that a

negligible load inductance results from the connection of the tubes to the transmission line.

4-26. The frequency is continuously variable by changing the electrical length of the flat plate parallel lines. The electrical length of these lines is controlled by the shorting fingers which are moved along the flat plate line by means of a pair of gear driver lead screws. Turning the FREQUENCY control changes the position of the shorting fingers on the plate lines. Some inductance is present in the cathodes because of their physical structures. To compensate for this inductance, cathode tuning is used. The cathode tuning elements are hollow tubes whose electrical length is varied by sliders which short the tubes to the chassis. The sliders are mechanically connected to the main tuning mechanism. An insulated wire inside the hollow tube serves as one lead to the filament. The other filament lead is the hollow tube itself.

4-27. The output from the plates of V301 and V302 is capacitively coupled to the transmission line by variable capacitor C324. Unbalance due to the method of output coupling is very small except at the low end of the frequency range. In order to compensate for this unbalance, an auxiliary variable capacitor C355 is built into the oscillator circuit. Capacitor C355 is mechanically coupled to the main tuning mechanism. Compensation for the unbalance is provided by C355 as the low end of the tuning range is approached. The output of the oscillator is connected to the ANTENNA connector J304.

4-28. A variable capacitor is connected between the plates of oscillator tubes V301 and V302. When the SWEEP RATE control is placed in the OFF position this capacitor is placed in a centered position. This is due to a magnetic centering brake on motor B301. The amplitude of voltage applied to the sweep motor is determined by the firing point of two type 2D21 thyratrons (V308, and V309). The bias on V308, V309 is controlled by SWEEP RATE control R325. This bias determines the speed at which the sweep motor rotates capacitor C360 (8 to 400 cps). A reference tachometer coupled to the motor shaft feeds on additional control voltage back to the thyratron grids to insure constant speed. Any increase or decrease in motor speed causes a like increase or decrease in the reference signal from the reference tachometer. Since the reference signal appears on the grids of V308 and V309 as a d-c control voltage, the motor speed is brought back to normal. The range of capacitance C360 determines the sweep width of the r-f output. This is approximately 7% of the r-f output frequency at the low end, and 10% at the high end of the band.

4-29. Plate voltage for V301 and V302 is supplied from the HIGH VOLTAGE connector J303 through C325, L312, C323, L301, and L311. Chokes L302 and L303, in the grid return circuit, effectively isolate the grid of the oscillator tubes from the modulator tube. Each choke consists of a straight piece of wire adequately insulated for high altitude operation. Capacitors C353 and C354 are low inductance feedback capacitors which are an integral part of the transmission line tuning assembly. They are used in plate

to grid coupling of the oscillator tubes. The r-f output is fed to the antenna through a reflectometer (Micromatch). The reflectometer is used to measure power to the antenna and power reflected from the antenna to give an indication of standing waves in the antenna transmission line. Reflectometer theory is explained in the following paragraphs.

4-30. REFLECTOMETER. (Fig. 4-5)

4-31. SWR (STANDING WAVE RATIO) MEASUREMENT.

a. Capacitance C represents the capacity between the loop and the inner conductor. Inductance M represents the mutual inductance of the loop and the inner conductor. Since the dimensions of the diameters are much smaller than the operating wavelength, lumped impedances may be used as in the equivalent circuit. Summing the voltage drops across R and M;

$$e = j\omega (CRE \pm MI)$$

The $\pm MI$ term is present since M may be (+) or (-).

b. From transmission line equations;

Incident wave = (E_i, I_i)

Reflected wave = (E_r, I_r)

and $E_i = I_i Z_o$ 1

$-E_r = I_r Z_o$ 2

(Where Z_o is the characteristic impedance of the line).

Reflection coefficient; $\rho = \frac{E_r}{E_i} = \frac{-I_r}{I_i}$ 3

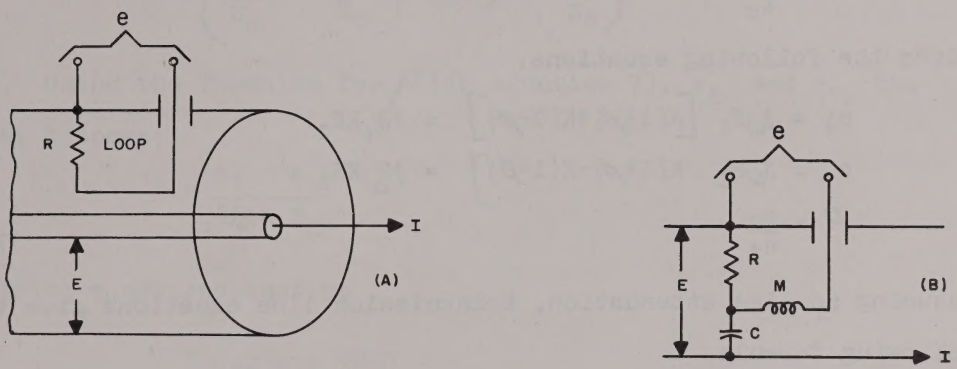


Figure 4-5. Functional Schematic Diagram of Reflectometer.

Resultant voltage; $E = (E_i + E_r)$ 4

Resultant current; $I = (I_i + I_r)$ 5

Using equations 1 through 5 in the expression for the voltage e shown in the figures; $e = j\omega (CRE \pm MI) = j\omega E_i \left[CR(1+\rho) \pm (\frac{M}{Z_o})(1-\rho)\right]$ For M(+) the equation yields e_+ and M(-) yields e_-. The change from e_+ to e_- is obtained by rotating the loop 180 degrees.

c. Choosing C, R, M, and Z_o such that;

$$CR = \frac{M}{Z_o} = K \text{ (K = a constant)} \qquad 6$$

gives the following equations.

$$e_+ = j\omega E_i \left[K(1+\rho)+K(1-\rho)\right] = j2\omega K E_i$$

$$e_- = j\omega E_i \left[K(1+\rho)-K(1-\rho)\right] = j2\omega K E_i$$

$$\rho = \frac{e_-}{e_+} \qquad 7$$

Assuming no line attenuation, transmission line equations give the following formula.

$$\text{SWR (Standing Wave Ratio)} = \frac{1+\rho}{1-\rho} = \frac{e_+ + e_-}{e_+ - e_-}$$

4-32. POWER MEASUREMENT.

a. Ignoring vector notation, the power passing through the line may be written as:

$$P = EI = (E_i + E_r)(I_i + I_r) = (E_i I_i + E_r I_i + E_r I_r + E_i I_r).$$

Since $E_r I_i = -E_i I_r$, this equation reduces to;

$$P = (E_i I_i + E_r I_r)$$

But; $E_i = I_i Z_o$

$-E_r = I_r Z_o$

$$\rho = \frac{e_-}{e_+} = \frac{E_r}{E_i} = \frac{-I_r}{I_i}$$

NOTE: E_i, E_r, and ρ, denote their respective magnitudes.

The power equation then is expressed as;

$$P = \left(\frac{E_i}{Z_o} - \frac{E_r}{Z_o} \right) = (1-\rho)\left(\frac{E_i}{Z_o} \right)$$

b. Using the formulas for ρ (in equation 7), e_+, and e_-, the power becomes;

$$P = \frac{e_+ - e_-}{4w K Z_o}$$

Defining a new constant k;

$$k = \frac{1}{4K Z_o}, \text{ then}$$

$$P = k \frac{e_+ - e_-}{w 2} \qquad 8$$

c. The quantity k depends on the circuit constants of the reflectometer. For these constants, M can be computed, R and Z_o can be measured and computed, and C is adjusted to a value which satisfies equation 6.

$$C = \frac{K}{R} = \frac{M}{RZ_o}$$

d. Equation 8 shows that for any load impedance at a known frequency, the reflectometer may be used to give the absolute power without a calibration of the known power. A circuit to measure power utilizing thermocouples is shown below.

4-33. MICROMATCH CIRCUIT. (Fig. 4-6)

a. The reflectometer used in Radio Transmitter T-465/ALT-7 is a commercial unit called a Micromatch. The Micromatch contains two loops to measure forward (incident) and back (reflected) power. Meter M301 is calibrated in watts and is used to obtain the forward and back power readings when the METER SWITCH is placed in the FWD PWR and BACK PWR positions, respectively. The actual power is obtained by subtracting the back power reading from the forward power reading and multiplying by 10.

b. The meter readings may also be used to calculate the VSWR (voltage standing wave ratio). The following formula is used for this purpose:

$$VSWR = \frac{\sqrt{\frac{\text{Forward Power}}{\text{Back Power}}} + 1}{\sqrt{\frac{\text{Forward Power}}{\text{Back Power}}} - 1}$$

c. The ALT-7 equipments should not be operated in installations where the VSWR is above 5 to 1. If the VSWR exceeds 5 to 1, the sweep capacitor will be damaged and rendered useless. Effort should be made to have installations where the VSWR is below 3 to 1. This will result in more radiated power and more effective jamming.

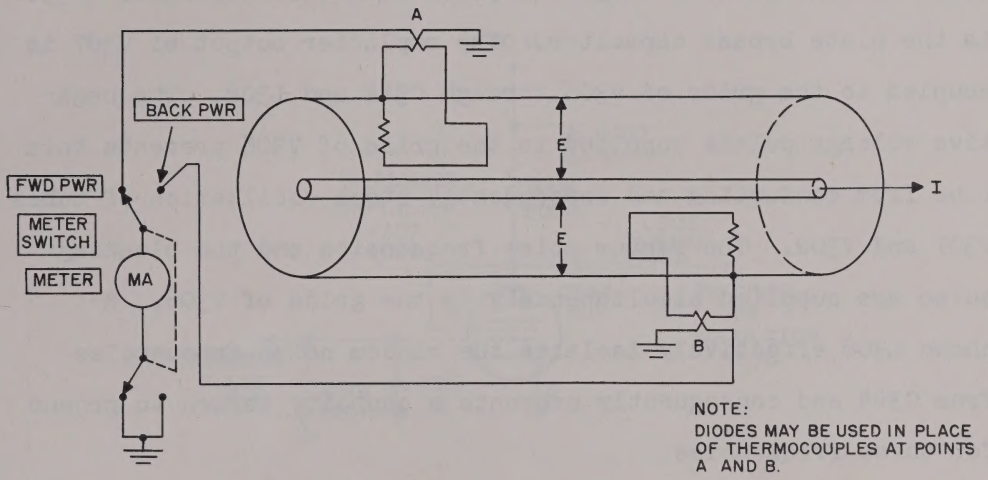


Figure 4-6. Schematic Diagram of Typical Reflectometer.

4-34. BLANKING AMPLIFIER.

4-35. Provisions have been made for blanking the oscillator tubes. Positive pulses having a minimum amplitude of 40 volts are supplied to the grid of the blanking amplifier tube V307 (figure 4-7). Tube V307 is a pentode type 6AQ6/6005 tube operated as a voltage amplifier. Resistor R319 is the grid lead resistor and C351 is an r-f bypass capacitor. The low voltage B+ is connected to the plate through the plate load resistor R318. C350 is the plate bypass capacitor. The amplifier output of V307 is coupled to the grids of V306 through C344 and L308. The negative voltage pulses supplied to the grids of V306 prevents this tube from conducting and consequently stops oscillation of tubes V301 and V302. The random noise frequencies and the blanking pulse are supplied simultaneously to the grids of V306. R-f choke L308 effectively isolates the random noise frequencies from C344 and consequently prevents a capacity return to ground for these frequencies.

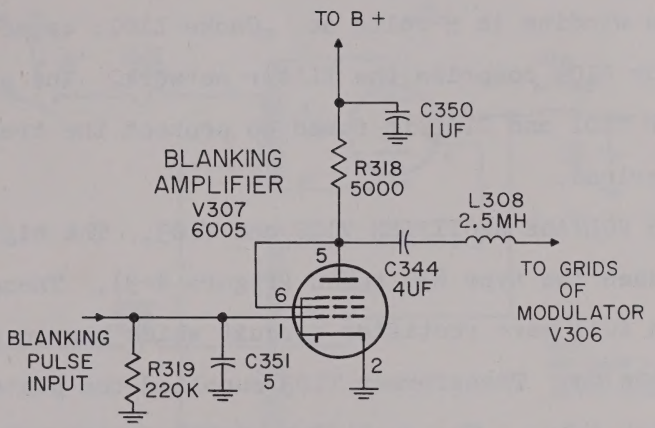


Figure 4-7. Radio Transmitter T-465/ALT-7 Blanking Amplifier, Simplified Diagram.

4-36. POWER SUPPLY PP-506/APT-6.

4-37. LOW VOLTAGE RECTIFIER V101. A type 5R4GY tube is used in the low voltage rectifier circuit (figure 4-8). This is a full wave rectifier with an output voltage of 290 volts at 250 ma. Plate voltage is supplied by the secondary of transformer T101. The voltage between each end of the secondary winding and the center tap is 410 volts ac. Filament voltage is provided by one of the secondary windings of transformer T102. The voltage across this winding is 5 volts ac. Choke L101, capacitor C101, and resistor R101 comprise the filter network. The primary of transformer T101 and T102 is fused to protect the transformer in case of overload.

4-38. HIGH VOLTAGE RECTIFIER V102 and V103. The high voltage rectifier uses two type 836 tubes (figure 4-9). These are connected in a full wave rectifier circuit which has an output of 900 to 1250 volts dc. Transformer T103 supplied the plate power for the rectifier tubes. The rectifier plate voltage may be varied by a three position OSCILLATOR PLATE VOLTAGE switch in primary circuit of the plate supply transformer. The primary winding is protected by fuse F103. Plate voltage is applied to the rectifier tubes when the PLATE switch is placed in the ON position. This closes the plate supply primary relay K103 and ac is applied to the primary of the plate supply transformer. Figure 7-2 shows the control circuits which operate relay K103. Filament power for the rectifier tubes is supplied by one of the secondary

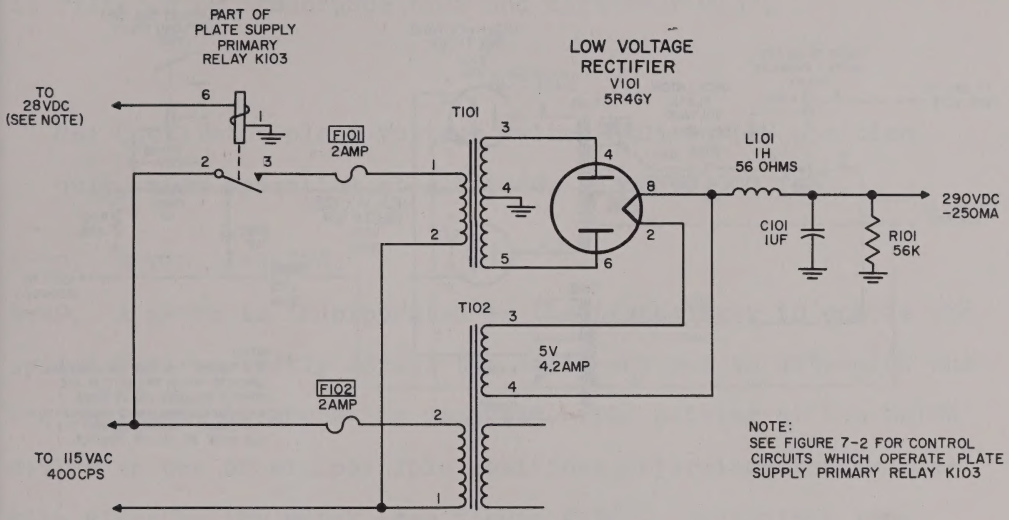


Figure 4-8. Power Supply PP-506/APT-6 Low Voltage Rectifier, Simplified Diagram.

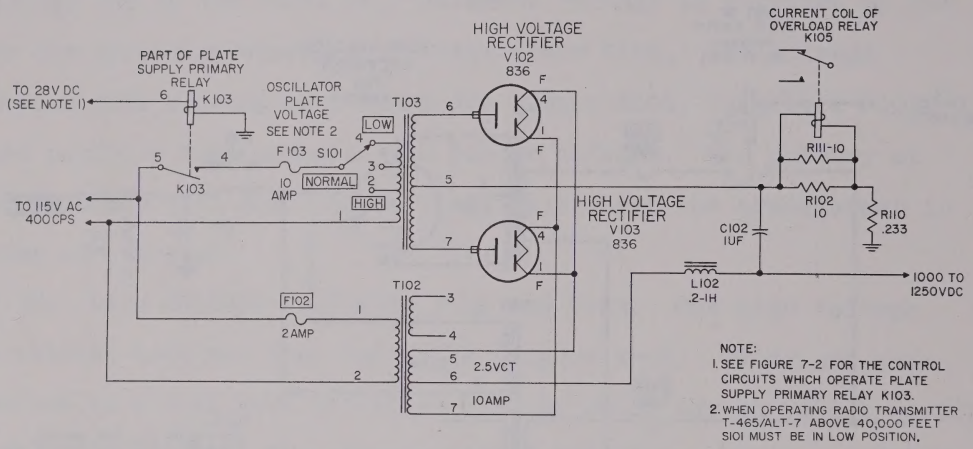


Figure 4-9. Power Supply PP-506/APT-6 High Voltage Rectifier, Simplified Diagram.

windings of filament transformer T102. The primary of this transformer is protected from overload by fuse F102. The high voltage power supply is further protected by overload relay K105. When the METER reading exceeds 17, with the METER SWITCH in the OSC AMPS 5-16 position, the overload relay operates. This removes the load from the power supply. The 900 to 1250 volt dc output is filtered by inductance L102 and capacitor C102.

CAUTION

Use Oscillator plate voltage switch S101 in LOW position only, when operating at altitudes above 40,000 feet.

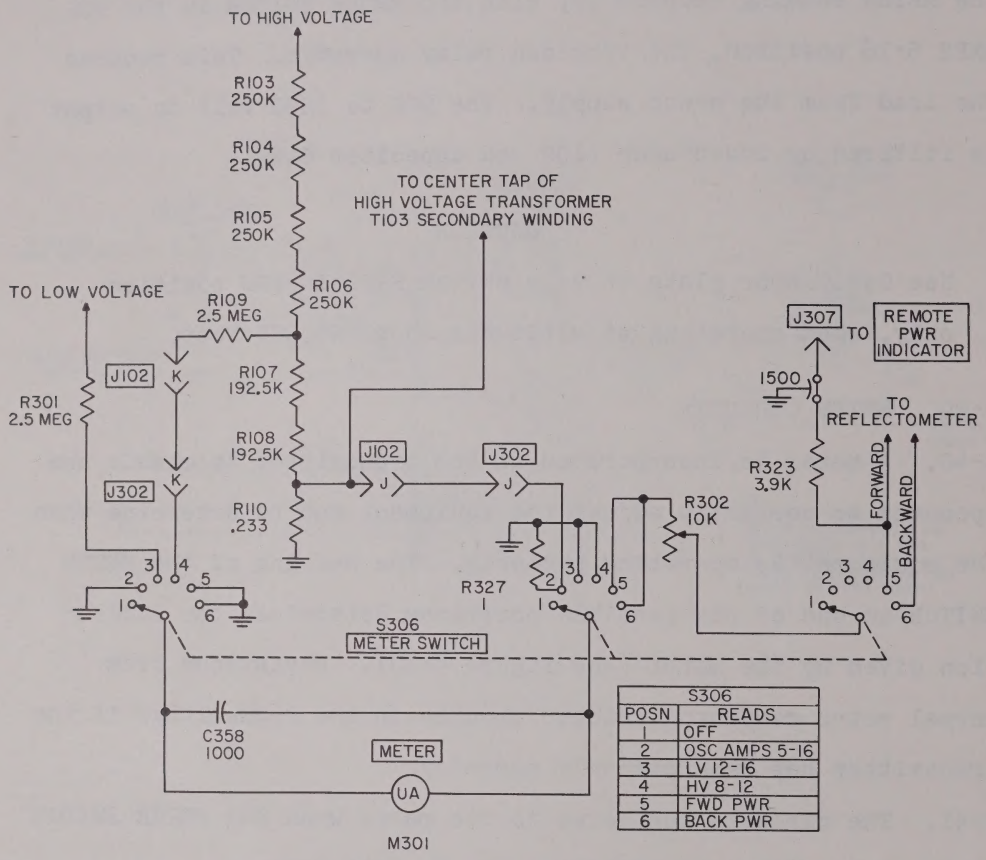
4-39. METER CIRCUITS.

4-40. A meter is incorporated in the transmitter to enable the operator to correctly adjust the equipment and to determine when the equipment is operating properly. The setting of the METER SWITCH in one of six possible positions determines the indication given by the meter (see figure 4-10). Deviations from normal meter readings indicate trouble in the transmitter if the transmitter has been properly operated.

4-41. The circuits connected to the meter when the METER SWITCH is in each of its six positions are as follows:

a. OFF. The meter is disconnected and has no function.

b. OSC AMPS 5-16. The meter reads the oscillator current of the transmitter. Care must be exercised to keep the oscillator



S306	
POSN	READS
1	OFF
2	OSC AMPS 5-16
3	LV 12-16
4	HV 8-12
5	FWD PWR
6	BACK PWR

Figure 4-10. Meter Circuits, Simplified Diagram.

current within this range to prevent damage to the oscillator. When the METER SWITCH is in this position, the METER is shunted by resistors R110 and R327. These resistors provide the return to ground for the current flowing through the secondary of plate supply transformer T103. A measure of the voltage drop across R110 and R327 is, therefore, a measure of the current flowing through the oscillator tubes of the transmitter.

c. LV 12-16. The meter is connected in series between voltage multiplier resistor R301 and ground. The opposite end of the multiplier resistor is connected to the low voltage supply. When the METER SWITCH is in this position, a METER reading in the range of 12 to 16 indicates that the low voltage supply is normal.

d. HV 8-12. The meter reads the high voltage supply of the high voltage rectifier. A METER reading in the range of 8-12 indicates that the high voltage supply is normal. When the METER SWITCH is in the HV 8-12 position the METER is connected in series with multiplier resistor R109 and ground. The opposite end of the multiplier resistor is connected to a position between resistors R106 and R107 which are part of a voltage divider network between the high voltage supply and ground. This voltage divider network consists of resistors R103 through R108 and resistor R110.

e. FWD PWR. The METER reads the incident power in the antenna transmission line. This incident power is obtained from the METER reading by multiplying the METER reading by 10. The figure thereby obtained is the incident power in watts. When the METER SWITCH

is in the FWD PWR position, the meter is connected to a Micromatch (standing wave ratio indicator) in the r-f output circuit of the oscillator.

f. BACK PWR. The meter reads the reflected power in the antenna transmission line. This reflected power is obtained from the METER reading by multiplying the METER reading by 10. The figure thereby obtained is the reflected power in watts. It is necessary to determine the incident and reflected power in order to calculate the actual power transmitted by the antenna. The actual power output is obtained by subtracting the BACK PWR reading from the FWD PWR reading and multiplying the answer by 10.

4-42. CONTROL CIRCUITS.

4-43. Figure 7-2, shows the control circuits of Power Supply PP-506/APT-6 and the transmitter. Reference symbols in the 100 series refer to components in the power supply, and the 300 series refer to components in the Transmitter.

4-44. The a-c power is applied to the heater element of time delay relay K101 and to blower motor relay K301. The d-c power is applied to the power switch through fuse F302. When the POWER switch is ON, d-c power is applied to the blower but a-c power is not applied immediately. The blower motor relay K301 must first be operated. The blower cools the oscillator tubes of the transmitter. The transmitter is thereby protected by not permitting operation until the blower motor is running. As soon as the blower goes on, a-c power is applied to the primary of filament

transformer T301 and T102. The primaries of these transformers are protected by fuses F301 and F102, respectively.

4-45. After the blower relay has operated, a-c power is applied to the heater element of time delay relay K101. The relay does not operate for 45 seconds. During the 45-second warm-up period, control interlock relay K102 is not operated. Two contacts are open and one is closed. The closed contact is in series with the heating element of relay K101 and completes the a-c path to the heating element. One of the open contacts keeps the d-c from the PLATE switch. This circuit arrangement prevents the application of PLATE power until the tubes have warmed up and time delay relay K101 has operated.

4-46. At the end of the 45-second warm-up period, relay K101 operates. This applies 28 volts d-c to the coil of control interlock relay K102. The two contacts of the relay that were open are now closed and the closed contact is now open. The closed contact which opened disconnects the a-c power from the heater element of relay K101. This causes the contacts of relay K101, through which d-c power was supplied to the coil of relay K102, to open. Relay K102 remains operated, however, because of the d-c applied through one of its own contacts. The other closed contact of relay K102 supplies 28 volts dc to the PLATE switch through antenna interlock relay K104 and overload reset relay K105. The plate power then cannot be applied until relay K101, relay K102, relay K104, and the relay K105 have been operated.

4-47. Relay K104 serves to disconnect the PLATE power of the

transmitter during the time antenna transfer switch S301 is switching antennas. One side of the antenna interlock relay coil is connected to 28 volts dc when the POWER switch is placed in the ON position. The circuit is completed to ground from the other side of the relay coil through the antenna transfer switch S301. As the antenna transfer switch is actuated, the d-c path through the antenna interlock relay coil is broken, thereby opening the relay contact. This removes the PLATE power of the transmitter. After the antennas have been transferred, the antenna interlock relay coil is again energized and PLATE power is applied.

4-48. The coil of plate supply primary relay K103 is connected to 28 volts dc through the plate switch, relay K105, relay K104, and relay K102. When the PLATE switch is placed in the ON position, relay K103 is operated. This applies a-c power to the primaries of plate supply transformers T101 and T103.

SECTION V

MAINTENANCE

5-1. SCOPE.

5-2. The trouble shooting and repair work that can be performed is necessarily limited in scope by the tools, test equipment, and replacement parts available and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned out tubes, blown fuses, etc.

5-3. Paragraphs 5-12 through 5-18 help in localizing the fault in the transmitter to the defective stage or item, such as a tube or fuse.

5-4. TEST EQUIPMENT.

5-5. The test equipment required for trouble shooting Radio Transmitter T-465/ALT-7 is listed below. The purpose or use of the test equipment is indicated.

TABLE VIII. TEST EQUIPMENT REQUIRED

Test Equipment	Used
R-f Wattmeter (Bird Electronic Corporation R-f Wattmeter Model 67 or equivalent).	Used as a dummy load and to check r-f power output.
Oscilloscope: Dumont type 304 or equivalent.	Used to isolate a trouble to a stage in the modulator section of the transmitter.
Pulse generator or square wave generator (Pulse Generator O-207/ALA-7 or equivalent).	Provides a blanking pulse to disable the transmitter.

TABLE VIII. TEST EQUIPMENT REQUIRED (cont)

Test Equipment	Use
Voltohmmeter (Simpson Model 260 or equivalent 20,000 ohms-per volt meter).	Used to make voltage and resistance measurements to determine the defective component within a stage.
Communication Receiver (must cover 168 to 352 mc range).	Monitors the r-f output of the transmitter.

5-6. SPECIAL TOOLS.

5-7. GENERAL. Three Bristol wrenches are supplied with the transmitter. These are used to remove or tighten Bristol type screws in the disassembly or assembly of the transmitter. Two Fahnestock type clips are located on the side of the oscillator dust cover. One of these clips holds a #6 and #4 wrench, and the other holds a #8 wrench.

5-8. FABRICATION OF CABLES FOR TEST BENCH SET-UP.

5-9. Four cables are required for the test bench set-up. These are the power cable, high voltage cable, the low voltage and control cable, and the antenna cable. For details of cable fabrication, refer to figures 5-1, 5-2, 5-3, and 5-4, respectively.

5-10. TEST BENCH SET-UP.

5-11. The test bench set-up shown in figure 5-5 is necessary for servicing the transmitter. The cable fabrication data necessary for this test bench set-up is given in paragraph 5-8. The test equipment required is listed in paragraph 5-4.

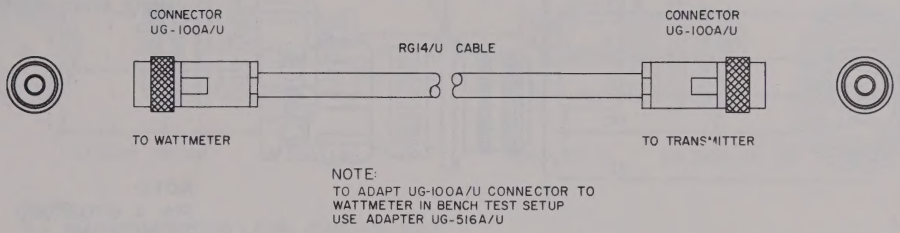
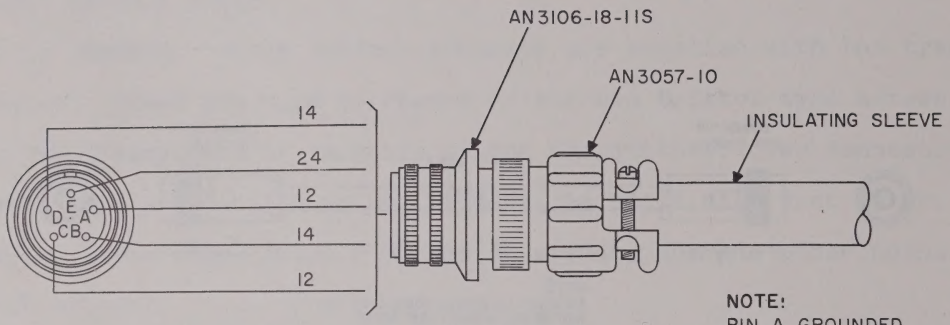
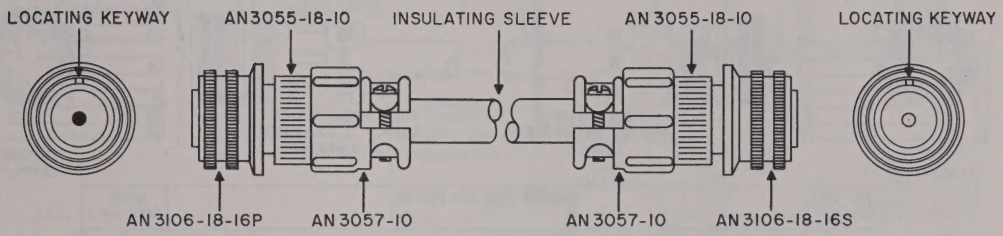


Figure 5-1. Antenna Cable.



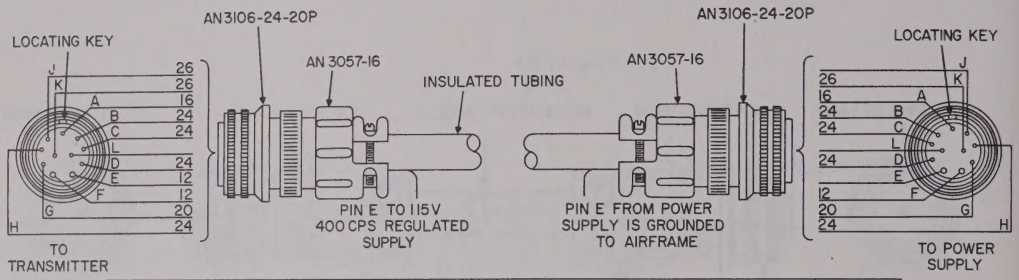
PIN OR SOCKET	DESCRIPTION AND RATING	WIRE SIZE AWG
A AND C	AC POWER LEAD. 115 VAC, 380/1000 CPS. 10.44 AMPS MAX. VOLT. DROP 1 VOLT MAX.	12
B	DC POWER LEAD. 30 VAC MAX. 6.38 AMPS MAX. VOLT. DROP 1 VOLT MAX.	14
D	DC POWER GROUND LEAD. 30 VAC MAX. 6.38 AMPS MAX. VOLT. DROP 1 VOLT MAX.	14
E	PANEL LAMPS. 30 VAC MAX. 240 MADC MAX. VOLT. DROP. 5 VOLT MAX.	24

Figure 5-2. Power Cable.



NOTE:
H.V. INTERCONNECTING LEAD. 1500 V DC MAX.
500 MA DC MAX. VOLTAGE DROP .5 VOLTS MAX.
WIRE SIZE NO. 20 AWG.

Figure 5-3. High Voltage Cable.



PIN OR SOCKET	DESCRIPTION AND RATING	WIRE SIZE AWG
A	GROUND LEAD 30 VDC MAX. 1.89 AMPS MAX.	16
B AND C	CONTROL, H.V. SWITCH. 30 VDC MAX. 200 MADC MAX. VOLT DROP .5 V MAX.	24
D	CONTROL, OVERLOAD. 30 VDC MAX. 200 MADC MAX. VOLT DROP .5 V MAX.	24
E	115 V, 400 CPS REGULATED.	12
F	115 V AC, 380/1000 CPS. 10.44 AMPS MAX. VOLT DROP .5 V MAX.	12
G	CONTROL VOLTAGE SUPPLY LEAD. 30 VDC MAX. 200 MADC MAX. VOLT DROP .5 V MAX.	20
H	CONTROL, ANTENNA TRANSFER. 29 V DC MAX. 200 MADC MAX. VOLT DROP .5 V MAX.	24
J	METER LEAD 1 VDC MAX. 200 U ADC MAX.	26
K	METER LEAD 250 VDC 200 U ADC MAX.	26
L	LOW VOLTAGE POWER LEAD. 250 V DC MAX. 250 MADC MAX. VOLT DROP .5 V MAX.	24

Figure 5-4. Low Voltage and Control Cable.

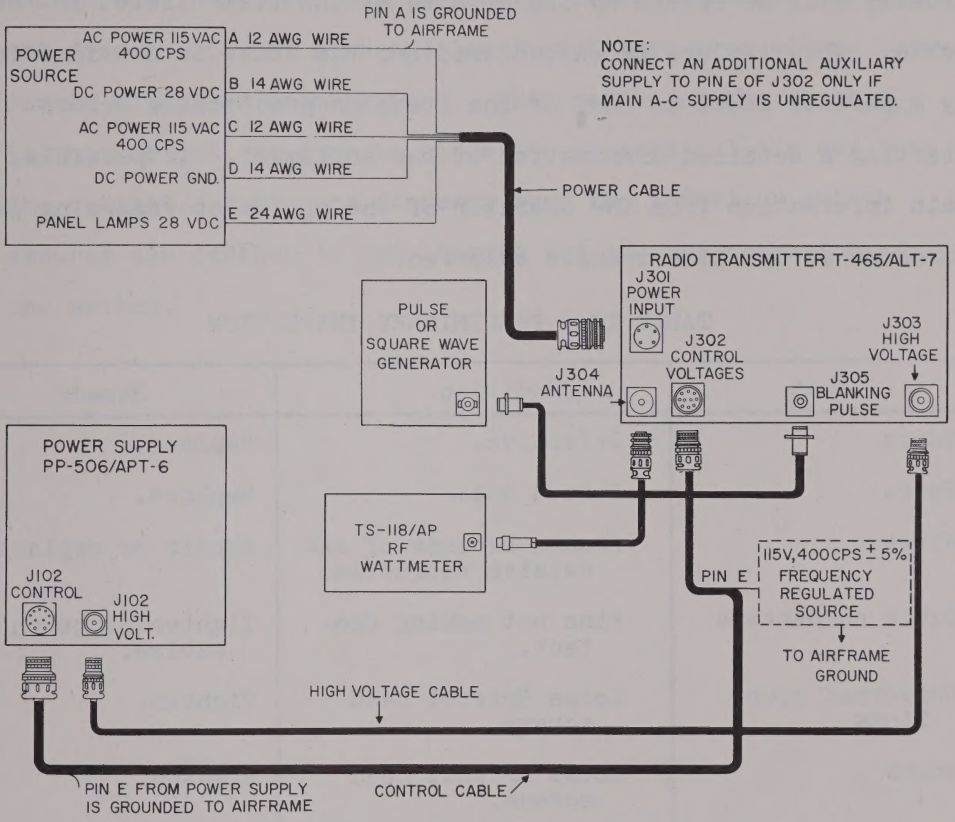

PIN A IS GROUNDED TO AIRFRAME
POWER SOURCE
AC POWER 115 VAC 400 CPS
DC POWER 28 VDC
AC POWER 115 VAC 400 CPS
DC POWER GND.
PANEL LAMPS 28 VDC
A 12 AWG WIRE
B 14 AWG WIRE
C 12 AWG WIRE
D 14 AWG WIRE
E 24 AWG WIRE
NOTE:
CONNECT AN ADDITIONAL AUXILIARY SUPPLY TO PIN E OF J302 ONLY IF MAIN A-C SUPPLY IS UNREGULATED.
POWER CABLE
RADIO TRANSMITTER T-465/ALT-7
J301 POWER INPUT
J302 CONTROL VOLTAGES
J303 HIGH VOLTAGE
J304 ANTENNA
J305 BLANKING PULSE
PULSE OR SQUARE WAVE GENERATOR
POWER SUPPLY PP-506/APT-6
J102 CONTROL
J102 HIGH VOLT.
TS-118/AP RF WATTMETER
PIN E
115V, 400CPS ± 5% FREQUENCY REGULATED SOURCE
TO AIRFRAME GROUND
HIGH VOLTAGE CABLE
PIN E FROM POWER SUPPLY IS GROUNDED TO AIRFRAME
CONTROL CABLE

Figure 5-5. Test Bench Set-Up.

5-12. PRELIMINARY INSPECTION.

5-13. Perform the preliminary inspection given in Table IX before checking the minimum performance standards (paragraph 5-14) of the equipment. Failure of the equipment to operate properly usually will be caused by one or more of the items listed in the table. When failure is encountered and the cause is not immediately apparent, check as many of the items as practicable before starting a detailed examination of the equipment. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

TABLE IX. PRELIMINARY INSPECTION

Part	Condition	Remedy
Tubes	Defective.	Replace.
Fuses	Burned out.	Replace.
Wires	Broken because of excessive vibration.	Repair or replace.
Cable connectors	Pins not making contact.	Tighten plugs on all cables.
Universal couplings	Loose Bristol head screws.	Tighten.
Knobs	Loose Bristol head screws.	Tighten.
Interlock switches	Not operated; no high or low voltage in the transmitter.	Depress the interlock switch at the rear of the transmitter and power supply chassis.

WARNING

High voltages are present when this equipment is turned ON. Use extreme care when replacing tubes. Turn the power OFF. A microswitch, located on the rear chassis apron of the transmitter and power supply, serves as an interlock switch and disconnects the high and low B+ voltages when either chassis is withdrawn from cabinet. When replacing the chassis in the cabinet, be sure to slide the chassis all the way into the cabinet. A Simmons fastener near the interlock switch secures the cabinet to the chassis and insures operation of the switch.

5-14. MINIMUM PERFORMANCE STANDARDS.

5-15. RADIO TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6. The performance steps for testing the equipment are given below.

a. PRELIMINARY STARTING.

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
1	Power Supply PP-506/APT 6.	OSCILLATOR PLATE VOLTAGE switch	Switch is set at LOW position.		
2	Transmitter T-465/ALT-7.	POWER switch	Switch is set at OFF position.		
3		PLATE switch	Switch is set at OFF position.		
4		METER switch	Switch is set at OSC AMPS position.		
5		MODULATION BANDWIDTH switch	Switch is set at cw position.		
6		ANT. COUPLING control	Control is set at position 4.		
7		FREQUENCY control	Set the FREQUENCY control to the desired frequency.		

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b. STARTING.

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
8	Transmitter T-465/ALT-7	POWER Switch	Set the switch to ON position.	Blower is running.	
				After approximately 45 seconds the TIME DELAY lamp lights.	Depress OVERLOAD RESET switch.
			Blower does not run and TIME DELAY lamp does not light.		Check fuse F302.
					Check Power cable connections at transmitter and at the power source.
					Check the power source for indications of output.
			Blower runs but TIME DELAY lamp does not light.		Depress interlock switch at rear of power supply.

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b. STARTING (cont).

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
					Tighten control cable connection at power supply and transmitter. Tighten antenna switch cable at transmitter and antenna switch actuator or place shorting on CAP REQ'D IF ANT SW NOT USED receptacle of transmitter. Replace TIME DELAY lamp. See paragraph 5-16.
9		PLATE switch	Set the switch ON.	The red PLATE indicating lamp lights. The METER reads between 5 to 16.	

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b. STARTING (cont).

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
			No indication on METER and PLATE indicating lamp lights.		Check fuse F101. Check fuse F102. Check fuse F103. Check high voltage rectifier tubes V102 and V103 in the power supply. See paragraph 5-16.
			No indication on METER and PLATE indicating lamp does not light.		Depress interlock switch S302 at rear of transmitter.
			No indication on PLATE indicating lamp.		Replace PLATE indicating lamp.
			METER indicates more than 16.		Turn ANT. COUPLING control counterclockwise until METER indicates 16.

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c. PERFORMANCE.

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
10		METER SWITCH	Set the switch to FWD PWR.	The METER deflects. The METER reading, when multiplied by 10, indicates the incident power in watts. Note the forward power.	See next Action or condition.
			No indication on METER.		Check crystal diode in forward power receptacle of SWR indicator. See paragraph 5-16.
			Set the switch to BACK PWR.	The METER deflects. The METER reading, when multiplied by 10, indicates the reflected power in watts. Note the back power.	See next Action or condition.
			No indication on METER.	No indication may be normal if antenna is matched perfectly.	Check crystal diode in back power receptacle of SWR indicator.

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Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
			Subtract the BACK PWR reading from the FWD PWR reading and multiply by 10. This is the actual power output.	The actual power output should be a minimum of 100 watts.	Proceed with next action or condition.
			Set the switch to OSC AMPS.	METER indicates between 5 and 16.	Proceed with Item No. 11.
11		ANT. COUPLING control	Actual power output is less than 100 watts.		Proceed with next action or condition.
			Turn control clockwise to increase coupling.	METER indicates an increase in oscillator current.	Repeat Item No. 10.
			Actual power output is more than 100 watts.		Proceed with next action or condition.
			Turn control counterclockwise to decrease coupling.	METER indicates a decrease in oscillator current.	Proceed with Item No. 12.

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c. PERFORMANCE (cont).

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
12		METER SWITCH	Repeat Item No. 10.	The actual power output should be 100 watts minimum.	See paragraph 5-16.
			Set the switch to LV position.	METER indicates between 12 and 16.	Check low voltage rectifier V101 in power supply.
					See paragraph 5-16.
			Set the switch to HV position.	METER indicates between 8 and 12.	See paragraph 5-16.
			Set the switch to FWD PWR position.		Proceed with Item No. 13.
			Set the switch to NARROW or WIDE position.		Proceed with next action or condition.
13		MODULATION BANDWIDTH switch.	Note the FWD PWR reading on the METER.	FWD PWR reading is less than the FWD PWR reading with MODULATION BANDWIDTH switch, set at cw.	Check tubes V303, V304, V305 and V306 in transmitter.
					Check cable connecting modulator output to the oscillator.
					See paragraph 5-16.

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Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
14		METER SWITCH	Set the switch to BACK PWR.		Proceed with next action or condition.
			Note the BACK PWR reading on METER.	BACK PWR reading is less than the BACK PWR reading with MODULATION BANDWIDTH switch set at cw.	Proceed with next action or condition.
			Subtract the BACK PWR reading from the FWD PWR reading and multiply by 10. This is the actual power output.	The actual power output should be approximately 100 watts at any frequency in the range of the transmitter.	Proceed with next action or condition.
			Set the switch to OSC AMPS.	METER indicates between 5 and 16.	Proceed with item 15.
15		ANT. COUPLING control	Actual power output is low.		Proceed with next action or condition.

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c. PERFORMANCE (cont).

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
			Turn control clockwise to increase coupling.	METER indicates an increase in oscillator current.	Repeat Item No. 13 and 14.
			Actual power output is high.		Proceed with next action or condition.
			Turn control counterclockwise to decrease coupling.	METER indicates a decrease in oscillator current.	Repeat Item No. 13 and 14.
				The actual power output should be approximately 100 watts depending upon the frequency.	See paragraph 5-16.

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d. Shutting:

Item No.	Unit	Item	Action or Condition	Normal Indications	Corrective measures
16		PLATE switch	Set the switch to OFF.	PLATE indicating lamp goes out.	
		POWER SWITCH	Set the switch to OFF.	TIME DELAY lamp goes out.	

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5-16. TROUBLE ANALYSIS.

5-17. Table X lists the trouble, probable cause and remedy when Radio Transmitter T-465/ALT-7 does not function properly. Troubles which might occur in the power supply are also listed in the table. To determine the trouble use the minimum performance standards. Then refer to the trouble column in the appropriate trouble shooting chart to determine the trouble, cause, and remedy.

TABLE X. TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6 TROUBLE ANALYSIS

Step	Trouble	Probable Cause	Remedy
1	No blower noise when POWER switch S305 is placed in the ON position.	Fuse F302 burned out.	Replace.
		Filter E305 open or shorted to ground.	Replace.
		POWER switch S305 is defective.	Replace.
		Coil winding of relay K301 open.	Replace.
		Blower motor winding open.	Replace.
		Shorted or open wiring.	Repair or replace.
2	TIME DELAY lamp I302 does not light after a 45 second time delay.	Blower relay K301 is defective.	Replace.
		The time delay relay K101 is defective.	Replace.
		Control interlock relay K102 is defective.	Replace.

TABLE X. TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6 TROUBLE ANALYSIS (cont)

Step	Trouble	Probable Cause	Remedy
		Antenna interlock relay K104 is defective.	Replace.
		Electrical reset overload relay K105 is defective.	Replace.
		Filter E303 or E304 open or shorted.	Replace.
3	PLATE indicating lamp I301 does not light but the TIME DELAY lamp I302 lights.	PLATE switch S303 is defective.	Replace.
4	No indication on METER M301 with METER SWITCH S306 in LV 12-16 position and the PLATE lamp I301 is lighted.	Plate supply relay K103 is defective.	Replace.
		Low resistance between filament of low voltage rectifier V101 and ground.	Replace capacitor C101.
		Filter E301 is open or shorted to ground.	Replace.
		Winding of transformer T101 or T102 open or shorted.	Replace.
		METER SWITCH S306 is defective.	Replace.
		Shorted or open wiring.	Repair or replace.

TABLE X. TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6 TROUBLE ANALYSIS (cont)

Step	Trouble	Probable Cause	Remedy
5	No METER indication with METER SWITCH S306 in the HV 8-12 position.	Low resistance between filament of high voltage rectifier tubes (V101 and V103) and ground.	Replace capacitor C356.
		Winding of transformer T102 or T103 open or shorted.	Replace.
		METER SWITCH S306 is defective.	Clean or replace.
		Shorted or open wiring.	Repair or replace.
6	No reading on METER with the METER SWITCH S306 in the OSC. AMPS 5-16 position and PLATE lamp I301 lighted.	METER SWITCH S306 is defective.	Clean or replace.
		Shorted or open wiring.	Repair or replace.
7	No r-f output as indicated by the wattmeter.	Short in r-f output transmission line.	Remove short.
		Defective circuit in the r-f oscillator. Check the voltages and resistances.	Make the necessary repairs indicated by an analysis of the voltages and resistances measurements.

TABLE X. TRANSMITTER T-465/ALT-7 AND POWER SUPPLY PP-506/APT-6 TROUBLE ANALYSIS (cont)

Step	Trouble	Probable Cause	Remedy
8	Low FWD PWR indicated on METER M301.	Low high voltage.	See step 5.
		FWD PWR crystal faulty or loose in holder.	Replace or tighten.
9	No BACK PWR indicated on METER M301.	May be normal if load is perfect.	Substitute a reactive load to check circuitry.
		BACK PWR crystal faulty or loose in holder.	Replace or tighten.
10	No modulation or the modulation bandwidth is too narrow or too wide.	Perform voltage and resistance checks in the tube socket at the defective stage.	Replace the faulty component as indicated by an analysis of the voltages and resistances at the tube socket of the defective stage.
		Improper voltages and resistances.	
		Cables or connectors between modulator and oscillator open or disconnected.	Replace, repair or tighten.
		MODULATION BANDWIDTH switch S307 defective.	Clean or replace.
11	The transmitter is not disabled when a positive pulse of 40 volts is applied to the BLANKING PULSE receptacle of the transmitter.	Open or shorted component in pulse amplifier circuit. Check voltages and resistances at the socket.	Replace defective component.

5-18. VOLTAGE AND RESISTANCE MEASUREMENTS.

5-19. When the trouble is localized to a particular stage of the equipment, it is sometimes necessary to make voltage and resistance measurements at the tube sockets in order to determine the defective component. Tables XI and XII give the voltages and resistance at the tube sockets of Radio Transmitter T-465/ALT-7; Tables XIII and XIV deal with Power Supply PP-506/APT-6. The voltage measurements were made with the transmitter operating with a minimum cw power output of 100 watts. The voltage and resistances were measured to ground with a 20,000 ohm-per-volt meter. The MODULATION BANDWIDTH switch is set to WIDE and the SWEEP RATE control is set to the OFF position. The OSCILLATOR PLATE VOLTAGE switch is set to the LOW position. All front panel cables are disconnected.

5-20. INSTALLATION OF OSCILLATOR TUBES IN TRANSMITTER T-465/ALT-7.

5-21. The tubes for Radio Transmitter T-465/ALT-7 are shipped installed in the transmitter. If it is necessary to replace one of the oscillator tubes (V301 or V302), the following procedure is used. Figure 5-6 illustrates the removal of oscillator tube V301. To remove V302 turn the transmitter chassis bottom side up and follow the same procedure.

a. Loosen the screws which hold the cover plate (1) to the oscillator dust cover. Lift the dust cover from the oscillator.

b. Unscrew the slotted machine screws (2) in each of the four teflon bushings and remove the four bushings.

c. Insert a screwdriver through the hole (3) in the back of the chassis and engage the slotted machine screw (4) which secures

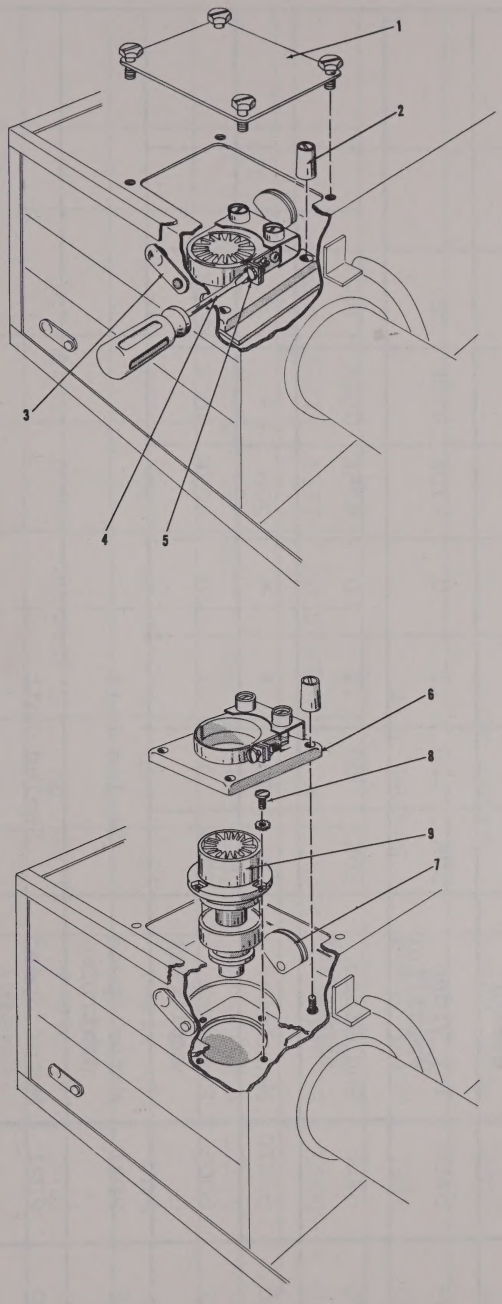

Figure 5-6. Radio Transmitter T-465/ALT-7 Removal of Oscillator Tubes.

TABLE XI. TRANSMITTER T-465/ALT-7 RESISTANCE MEASUREMENTS

Ref. Symbol	Tube	Stage	Pin Numbers								
			1	2	3	4	5	6	7	8	Plate
V301	6161	Oscillator									*
V302	6161	Oscillator									*
V303	6D4	Noise Generator	0	0	.1	0	0	0	457K		
V304	6AU6	1st Video Amplifier	56K	120	.1	0	410K	466K	120		
V305	6AU6	2nd Video Amplifier	56K	68	.1	0	425K	432K	68		
V306	6AS70	Modulator	*	200	*	*	200	*	*	*	
V307	6005	Blanking Amplifier	220K	0	.1	0	405K	400K	220K		
V308	2D21	Motor Speed Control	Sealed Unit								
V309	2D21	Motor Speed Control	Sealed Unit								

* Denotes infinity.

TABLE XII. TRANSMITTER T-465/ALT-7 VOLTAGE MEASUREMENTS

Ref Symbol	Tube	Stage	Pin Numbers								
			1	2	3	4	5	6	7	8	Plate
V301	6161	Oscillator									1000V
V302	6161	Oscillator									1000V
V303	6D4	Noise Generator	0V	0V	6.3VAC	0V	0V	0V	17V		
V304	6AU6	1st Video Amplifier	-11.5V	.8V	6.3VAC	0V	280V	164V	.8V		
V305	6AU6	2nd Video Amplifier	-13V	.86V	6.3VAC	0V	280V	168V	.86V		
V306	6AS7G	Modulator	-78V	-33.5V	-75V	-78V	-33.5V	-75V	6.3VAC*	6.3 VAC*	
V307	6005	Blanking Amplifier	-.9V	0V	6.2VAC	0V	115V	115V	-.9V		
V308	2D21	Motor Speed Control	Sealed Unit								
V309	2D21	Motor Speed Control	Sealed Unit								

* Indicates measurement across filament.

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TABLE XIII. POWER SUPPLY PP-506/APT-6 RESISTANCE MEASUREMENTS

Ref. Symbol	Tube	Stage	Pin Numbers								Plate Cap
			1	2	3	4	5	6	7	8	
V101	5R4GY	Low Voltage Rectifier	NC	56K	NC	14.5	NC	13	NC	65K	
V102	836	High Voltage Rectifier	1.4 meg	NC	NC	1.4 meg					22
V103	836	High Voltage Rectifier	1.4 meg	NC	NC	1.4 meg					21

TABLE XIV. POWER SUPPLY PP-506/APT-6 VOLTAGE MEASUREMENTS

Ref. Symbol	Tube	Stage	Pin Numbers								Plate Cap
			1	2	3	4	5	6	7	8	
V101	5R4GY	Low Voltage Rectifier	NC	290V	NC	420VAC	NC	420VAC	NC	290V	
V102	836	High Voltage Rectifier	2.4 VAC*	NC	NC	2.4VAC*					1000V
V103	836	High Voltage Rectifier	2.4 VAC*	NC	NC	2.4VAC*					1000V

* Indicates measurement across filament.

the clamp around the anode of the tube. Remove the anode clamp and teflon insulation plate (5).

d. Unscrew the three machine screws (6) which hold the oscillator tube. Remove the oscillator tubes (V301 and V302).

e. To replace tubes V301 and V302 reverse the procedure given above.

5-22. INSTALLING OTHER TUBES IN TRANSMITTER T-465/ALT-7.

5-23. No special instructions are necessary for removing or installing the other tubes in the transmitter. If it is necessary to replace one of these tubes because of failure, care must be exercised in removing or inserting them as the pins are easily bent or damaged. See figure 5-7 for the tube locations of the transmitter.

5-24. A magnet surrounds the base of the noise generator tube V303. The magnet is held in place by a metal sleeve which is part of the tube socket. This sleeve is crimped to keep the magnet in place. The type 6D4 tube may be removed by grasping the top of the tube and pulling upward. The magnet does not have to be removed. A tube puller may be used if one is available.

5-25. If for any reason it becomes necessary to replace the magnet it is necessary to remove the tube first, then uncrimp the sleeve and remove the magnet. It is necessary to orient the new magnet since the original magnet was oriented in the proper position at the factory. It should be oriented by observing the proper bandwidth pattern on the screen of the oscilloscope.

5-26. SETTING ANTENNA SWITCH OF TRANSMITTER T-465/ALT-7.

5-27. SETTING TRANSFER POINT. The low range of r-f output of the

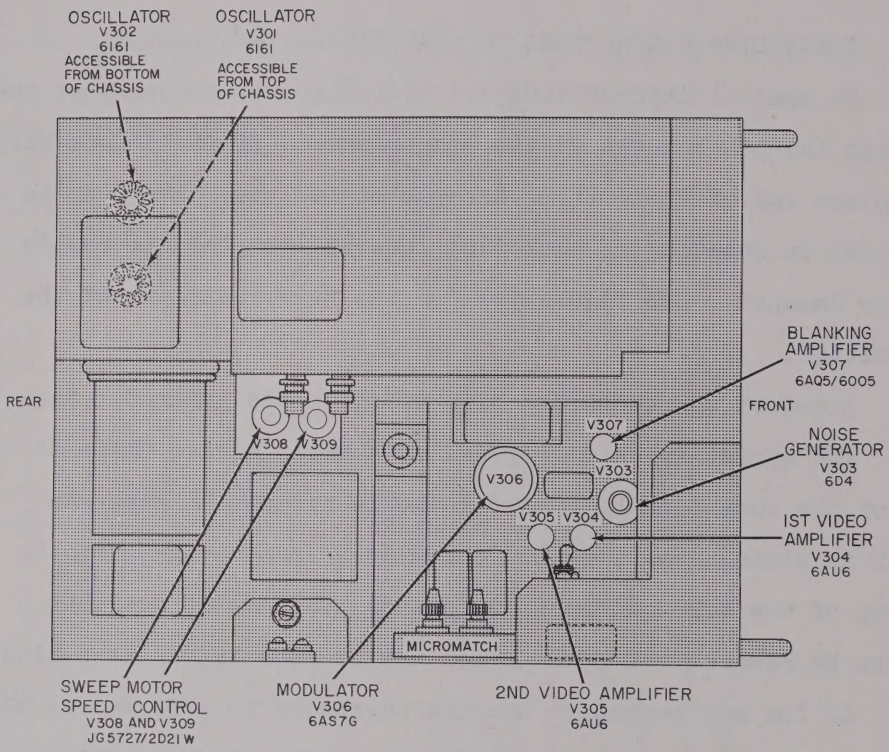


Figure 5-7. Radio Transmitter T-465/ALT-7, Tube Location.

transmitter is fed to one antenna and the high range is fed to another in order to maintain radiation efficiency. The frequency at which antenna transfer is made is determined by the setting of the antenna switch actuator (1, figure 5-8) on the calibrated dial (2). The actuator is set as follows.

a. Unscrew and remove the captive cap (3) located on the front panel.

b. Rotate the FREQUENCY control until the antenna switch actuator appears behind the hole on the front panel.

c. Insert a Phillips-head screwdriver through the hole (4), and engage the bottom Phillips-head screw (5).

d. Loosen this screw and then while holding it in position, crank the frequency control until the desired change-over frequency corresponds to the index line (6). Tighten the screw (5).

5-28. SETTING AMOUNT OF OVER-TRAVEL.

a. Follow the procedures indicated in steps a and b of paragraph 5-27 above.

b. Insert a Phillips-head screwdriver through the hole and engage the top Phillips-head screw (7, figure 5-8).

c. Turn this screw counterclockwise to increase the amount of frequency over-travel (8) and clockwise to decrease the amount of frequency over-travel (8).

d. Replace the cap (3) removed in step a of paragraph 5-27.

5-29. WATTMETER CALIBRATION OF TRANSMITTER T-465/ALT-7.

5-30. The METER on Radio Transmitter T-465/ALT-7 is calibrated to read the FWD PWR and BACK PWR of the transmitter. It is calibrated at the mid-range frequency (260 mc) at the factory. The mid-

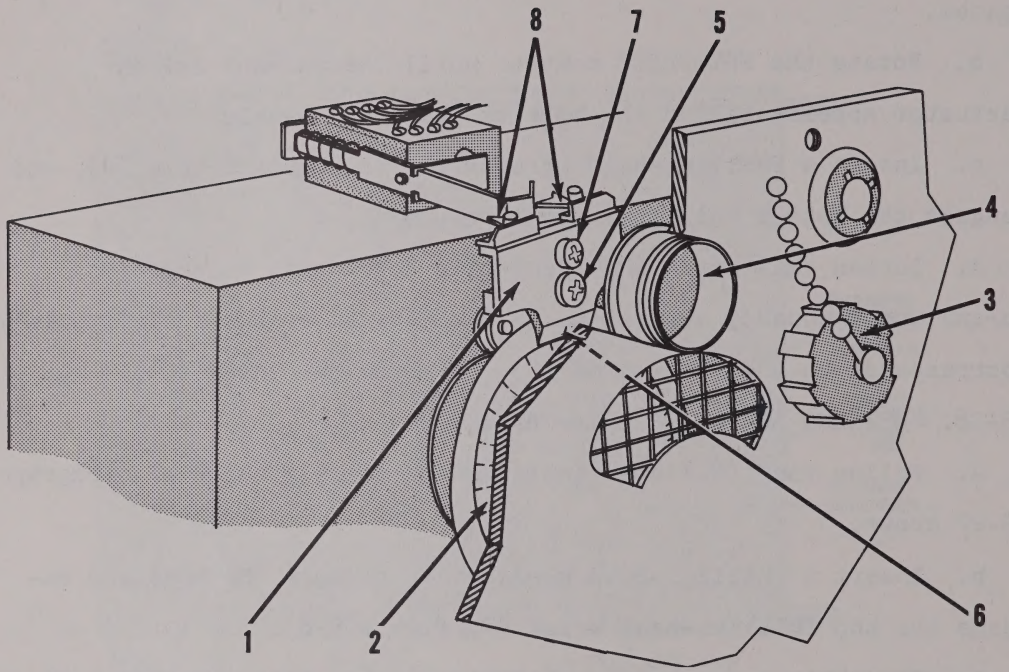


Figure 5-8. Radio Transmitter T-465/ALT-7, Antenna Switch Adjustment.

frequency at which the METER is calibrated is the only frequency that an accurate power measurement can be made without recalibration at the new frequency. Each transmitter is calibrated individually at the factory. If it becomes necessary to recalibrate the METER proceed as follows.

a. Install the equipment in the test bench set-up figure 5-5.

CAUTION

Never apply high voltage to the transmitter unless an antenna or dummy load is connected. If PLATE power is applied without a load connected to the transmitter the SWR indicator may be damaged.

b. Set the FREQUENCY control to the desired calibration frequency.

c. Set the ANT. COUPLING control to 4.

d. Set the METER SWITCH to FWD PWR.

e. Set the MODULATION BANDWIDTH switch to cw.

f. Set the POWER switch to the ON position.

g. After a 45-second time delay the TIME DELAY indicator will light.

h. Set the PLATE switch to the ON position.

i. Adjust the ANT. COUPLING control for a 100 watt reading on the wattmeter.

j. Adjust the power calibration resistor R302 so that the METER on the transmitter reads 14.

k. The calibration of the METER is complete.

5-31. DISASSEMBLY OF BLOWER.

5-32. It is recommended that the blower motor brushes be replaced at the end of every 200 hours of use because of motor brush wear. While the brushes are rated at 250 hours of use, it is felt that 200 hours will provide reliable operation. The motor brushes are replaced as follows:

a. Disconnect the two leads at the top of the blower and remove the blower from the chassis.

b. After the blower has been removed from the transmitter, remove the circular air vane at the outlet by removing the single screw which secures it to the housing. Lift the vane out of the housing.

c. Using a number 8 Bristol wrench, remove the set screw holding the rotor to the motor shaft and remove the rotor.

d. Four screws holding the motor to the blower housing are exposed after the rotor is removed. Remove these screws.

e. Disconnect the motor wires from the terminals at the top of the housing. Remove the motor from the housing.

f. Remove the four screws holding the motor and bell and remove the bell. The old brushes may now be removed and new ones inserted in the brush holder.

g. Before reassembling the blower, be sure to clean all the parts. This can be done with a clean cloth or with compressed air if that is available.

5-33. REMOVAL AND REPLACEMENT OF SWEEP MOTOR IN RADIO TRANSMITTER T-465/ALT-7.

5-34. The sweep unit consists of capacitor C360 and motor B301. The sweep capacitor alignment is critical and should not be attempted without the special tools and equipment necessary to perform the alignment. To remove the sweep motor proceed as follows:

a. Remove the six screws (1, figure 5-9) that hold the inspection cover (2) in place.

CAUTION

Do not loosen any Bristol-head set screws. They are preset at the factory and are staked in place with glyptal. Do not loosen screws on motor support block. Altering position of this block will result in misalignment of the sweep capacitor.

b. Loosen the two motor mounting screws (3), unplug P315 (4), and remove the motor (5).

c. Prior to replacing the motor clean the sweep capacitor in the following manner.

(1) Using a soft lint-free cloth dipped in MEK (menthol-ethyl-keyton), carefully wipe off all dirt, lint, moisture, and finger marks from the stator (6) and rotor (7) of the capacitor.

(2) Wipe dry with a clean lint-free cloth.

(3) Coat the surface of the stator and rotor plates with Dow Corning silicone dielectric compound (DC4). Apply the DC4 with a clean lint-free cloth.

5-37. RUSTPROOFING AND PAINTING.

5-38. When the finish on the cases is badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces: use No. 00 or No. 000 sandpaper to clean the surface down to bare metal; obtain a bright, smooth finish.

CAUTION

Do not use steel wool. Minute particles frequently enter the cases and cause harmful internal shorting or grounding of circuits.

SECTION VI

PARTS LIST

Ref. Symbol	Name and Description	Part No.
B301	Motor-Tachometer; WAC	A-2043
B302	Blower, Axivane type; electric motor operated; Joy Mfg Co.	20D059
C301 C302 C303 C304 C305 C306 C307 C308 C309 C310 C313 C314 C315 C316 C317 C318 C319 C321 C327 C340 C341 C342 C343 C352	Capacitor, Fixed; Ceramic dielectric; feedthru type; 1,500 uuf ±20%; 500 vdcw; Centralab	DA721-000
C311 C312 C339	Capacitor, Fixed: Ceramic dielectric; feedthru type; 1,000 uuf ±20%; 1,500 vdcw; Centralab	DA720
C322 C330	Capacitor, Fixed: Ceramic dielectric; 1,000 uuf ±20%; 1,000 vdc; Centralab	DA722-000
C323 C325	Capacitor, Fixed: Ceramic dielectric; feedthru type; 250 uuf ±25 uuf; 2,000 vdcw; Erie Resistor Corp.	701B
C331 C332 C333	Capacitor, Fixed: Mica dielectric; 10,000 uuf ±10%; per MIL-C-5	CM35A103K

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
C334 C335 C336 C337	Capacitor, Fixed: Paper dielectric; 100,000 uuf ±27%; per MIL-C-25A.	CP55B5FF104M
C338	Capacitor, Fixed: Mica dielectric; 2,200 uuf ±10%; per MIL-C-5.	CM35A222K
C344	Capacitor, Fixed: Paper dielectric; 4 ufd, ±10%; MIL-C-25A.	CP70E1EF405K
C345 C346 C347 C348 C349 C351	Capacitor, Fixed: Ceramic dielectric; 5 ufd ±1 uufd 500 vdc, Centralab.	DA-341-000
C350	Capacitor, Fixed: Paper dielectric; 1 uf +20% -10%; per MIL-C-25A.	CP61B1EF105V
C356	Capacitor, Fixed: Mica dielectric; 10,000 uuf ±10%; per MIL-C-5.	CM60B103K
C357	Capacitor, Fixed: Paper dielectric; 100,000 uuf ±20%; per MIL-C-25A.	CP54B5EF104M
C358	Capacitor, Fixed: Ceramic dielectric; 1,000 uuf 600 vdc.	DA-141-001B
C360	Capacitor, variable air dielectric.	28B208
C361	Capacitor, Fixed: Paper dielectric; .15 uf ±10% 600 vdc, Cornell-Dubilier.	MYRT6015J
CR301 CR302	Crystal, Rectifying.	1N21B
E301	Suppressor, Electrical Noise: 600v DC 1 amp; Astron Corp.	AF623
E302	Suppressor, Electrical Noise: 50v DC, 2 amp; Astron Corp.	AF621
E303 E304	Suppressor, Electrical Noise: 130v AC, 10 amp; Astron Corp.	AF624

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
E305	Suppressor, Electrical Noise: 50v DC, 10 amp; Astron Corp.	AF622
E306	Suppressor, Electrical Noise: 130v AC, .5 amp; Astron Corp.	AF949
F301	Fuse, Cartridge: 2 amp; Littelfuse.	413002
F302	Fuse, Cartridge: 10 amp; Littelfuse.	413010
I301	Light, Indicator: red Dialco.	11-3730-111
I302	Light, Indicator: green Dialco.	11-3730-112
I303 I304 I305 I306 I307 I308 I309 I310	Light, Panel: 28v DC; .04 amperes; red filter; Grimes.	A-5885-327
J301	Connector, Receptacle: 5 male contacts; per MIL-C-5015A.	AN3102A-18-11P
J302	Connector, Receptacle: 11 female contacts; per MIL-C-5015A.	AN3102A-24-20S
J303	Connector, Receptacle: 1 male contact; per MIL-C-5015A.	AN3102A-18-16P
J304	Connector, Receptacle: 1 female contact; per MIL-C-3608.	UG-101A/U
J305	Connector, Receptacle: 1 female contact; per MIL-C-3608.	UG-262A/U
J306	Connector, Receptacle: 6 male contacts; per MIL-C-5015A.	AN3102-18-12P
J307	Connector, Receptacle: 1 female contact; per MIL-C-5015A.	AN3102A-8S-1S

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
J308 J309 J310 J312 J313	Connector, Receptacle: 1 female contact; per MIL-C-3608.	UG-290/U
J314	Connector, Receptacle: 18 female contacts.	10B701
J311	Connector, Receptacle: 7 male contacts; per MIL-C-5015A.	AN3102A-16S-1P
J315	Connector, Receptacle: 5 female contacts.	10B681
K301	Relay; SPST; 115v AC 15 amps., .14 ohms resistance, 4.7 amps operating current; Advance Electric and Relay Co.	E8765-1
L301	Coil, Radio Frequency.	53-315
L304 L308	Coil, Radio Frequency: 2.5 mh at 250 KC.	53B308
L305	Coil, Radio Frequency: .35 mh	53-319
L309 L310 L311 L312	Coil, Radio Frequency: 7 uh; Ohmite.	Z50
M301	Ammeter.	82B247
P308 P309 P310 P313	Connector, Plug: 1 male contact; per MIL-C-3608.	UG-260A/U
P315	Connector, Plug: 5 male contacts	
P311	Connector, Receptacle: 7 female contacts; per MIL-C-5015A.	AN3106A-16S-1S
P312	Connector, Receptacle: 1 male contact; per MIL-C-3608.	UG-260A/U

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
R301	Resistor, Fixed: Deposited carbon; 2.5 megohms ±1%, 2 watts; International Resistance Corp.	DCH
R302	Resistor, Variable: Composition; 10,000 ohms ±10%, 2 watts; Allen-Bradley Co.	JLU1031
R303 R304	Resistor, Fixed: Wirewound; 25 ohms ± 10%; 10 watts.	24BG250E
R305	Resistor, Fixed: Composition; 47,000 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF473K
R306 R307 R309	Resistor, Fixed: Composition; 56,000 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF563K
R308 R313 R315 R316	Resistor, Fixed: Composition; 10,000 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF103K
R310	Resistor, Fixed: Composition; 22,000 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF223K
R311	Resistor, Fixed: Composition; 15K ohms ±10%, 2 watts, per MIL-R-11A.	RC42OF153K
R312	Resistor, Fixed: Composition; 120 ohms ±10%, 1 watt, per MIL-R-11A.	RC30BF121K
R314	Resistor, Fixed: Composition; 68 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF680K
R317	Resistor, Fixed: Wirewound, 50 ohms ±10%, 10 watts.	24BF500E
R318	Resistor, Fixed: Wirewound, 5,000 ohms ±10%, 10 watts.	24BF502E
R319	Resistor, Fixed: Composition; 220,000 ohms ±10%, 1 watt, per MIL-R-11A.	RC30BF224K
R320 R322	Resistor, Fixed: Composition; 27,000 ohms ±10%, 1 watt; per MIL-R-11A.	RC30BF273K
R321	Resistor, Fixed: Wirewound, 200 ohms ±10%.	24BF201E

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
R323	Resistor, Fixed: Composition; 3900 ohms ±10%, 2 watts; per MIL-R-11A.	RC42BF392K
R324	Resistor, Fixed: Composition; 150,000 ohms ±10%, 1 watt.	RC30BF154K
R325	Resistor, Variable: Wirewound; 0.25 megohms, (includes S309).	25B1142
R326	Resistor, Variable: Wirewound; .01 megohms.	25B1143
R327	Resistor, Fixed, Wirewound; 1 ohm ±5%, 1/2 watt.	RU3B1RDJ
R328	Resistor, Fixed, composition; 100,000 ohms ±10%, 1/2 watt.	RC20BF104K
R329 R330	Resistor, Fixed, composition; 470 ohms ±10%, 1/2 watt.	RC20BF471K
S301	Switch, Sensitive: DPDT; Electro-Snap.	D8-304
S302 S304	Switch, Sensitive: SPDT; per JAN-S-63.	SS03B70
S303	Switch, Toggle: DPST; per JAN-S-23.	ST52K
S305	Switch, Toggle: DPST; per JAN-S-23.	ST52K
S306	Switch, Rotary: Wafer type; 3 sections, 6 positions.	60C574
S307	Switch, Rotary: Wafer type; 3 section, 3 position.	60C597
S308	Switch, Toggle: SPDT; per JAN-S-23.	ST42D
TP301 TP302 TP304	Connector, Receptacle: Tip jack type; 1 female contact; red nylon insulation; E. F. Johnson.	105-602-1
TP303 TP305	Connector, Receptacle: Tip jack type; 1 female contact; black nylon insulation; E. F. Johnson.	105-603-1
T301	Transformer, Filament.	52D340

PARTS LIST (cont)

Ref. Symbol	Name and Description	Part No.
V301 V302	Tube, Electron; 6161.	6161
V303	Tube, Electron: Gas triode; 6D4; per MIL-E-1B.	6D4
V304 V305	Tube, Electron: 6AU6; per MIL-E-1B.	6AU6
V306	Tube, Electron; 6AS7G; per MIL-E-1B.	6AS7G
V307	Tube, Electron; 6AQ5/6005; per MIL-E-1B.	6005/6AQ5
V308	Tube, Electron; Thyratron; 2D21W; per MIL-E-1B.	2D21W
V309	Tube, Electron: 2D21W; per MIL-E-1B.	2D21W
X303	Socket, Tube: 7 pin miniature, Cinch.	14558
X304 X305 X306 X307	Socket, Tube: Octal type per JAN-S-28A.	TS102P01
Z301	Regulator, Sweep Motor; WAC	B2151
Z302	Micromatch, Indicator, standing wave; M. C. Jones Electronics.	574.8

SECTION VII

DIAGRAMS

7-1. GENERAL.

7-2. This section contains diagrams and associated data necessary for maintenance technicians to service Radio Transmitter T-465/ALT-7. The key to proper utilization of this material is the index of diagrams (par. 6-3). All electrical components, which appear on the schematic diagrams may be located in the equipment by referring to the halftone illustrations. The component parts are called out.

7-3. INDEX OF DIAGRAMS.

7-4. The diagrams are listed in the order of their appearance in this section.

Figure	Title
7-1	Radio Transmitter T-465/ALT-7, B+ Voltage Distribution.
7-2	Control Circuits.
7-3	Radio Transmitter T-465/ALT-7, Top View.
7-4	Radio Transmitter T-465/ALT-7, Inside Front Panel.
7-5	Radio Transmitter T-465/ALT-7, Bottom View.
7-6	Radio Transmitter T-465/ALT-7, Left Side.
7-7	Radio Transmitter T-465/ALT-7, Oscillator Removed.
7-8	Radio Transmitter T-465/ALT-7, Rear View.
7-9	Radio Transmitter T-465/ALT-7 Oscillator, Oblique Views.
7-10	Sweep Motor Speed Regulator.
7-11	Radio Transmitter T-465/ALT-7, Schematic Diagram.
7-12	Power Supply PP-506/APT-6, Schematic Diagram.

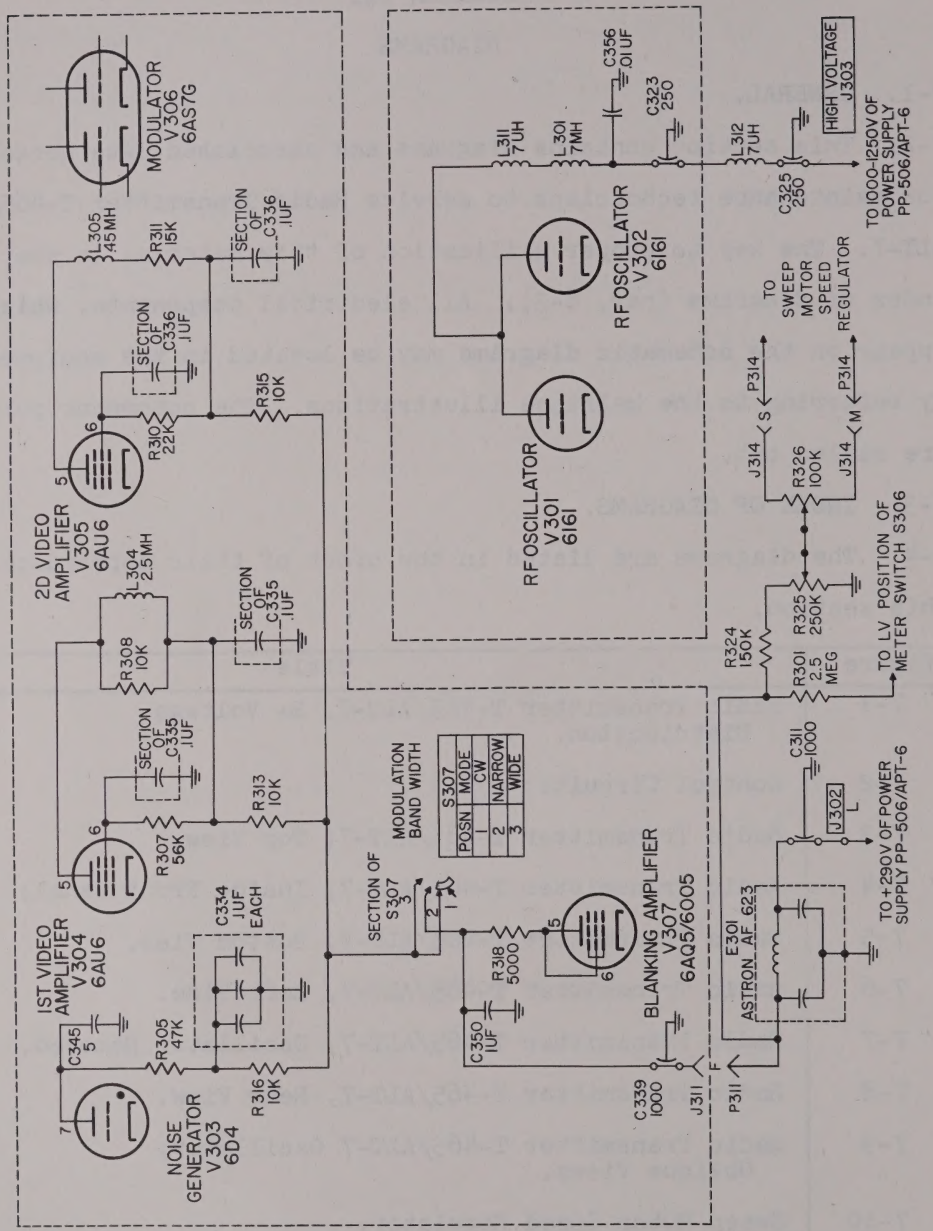


Figure 7-1. Radio Transmitter T-465/ALT-7, B+ Voltage Distribution.

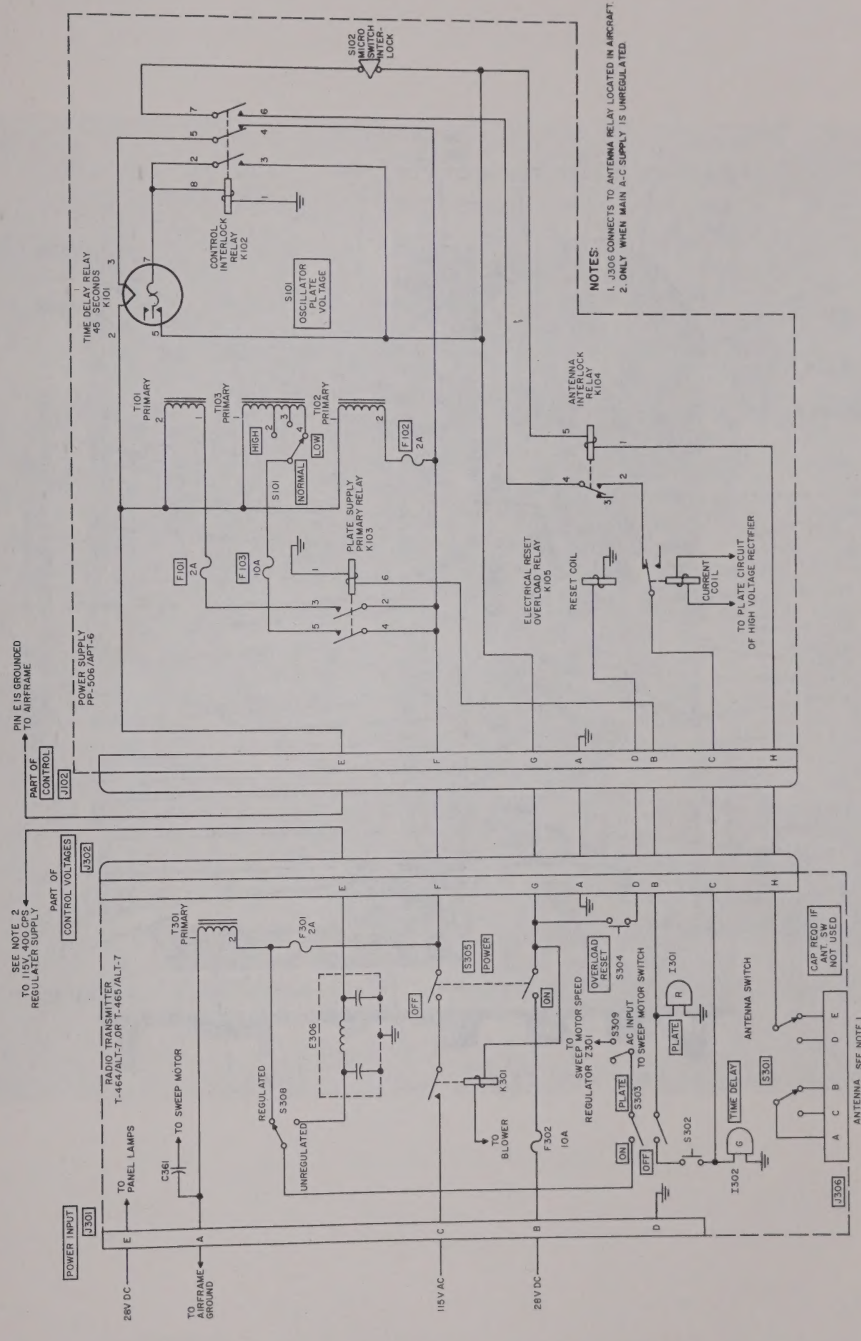


Figure 7-2. Control Circuits.

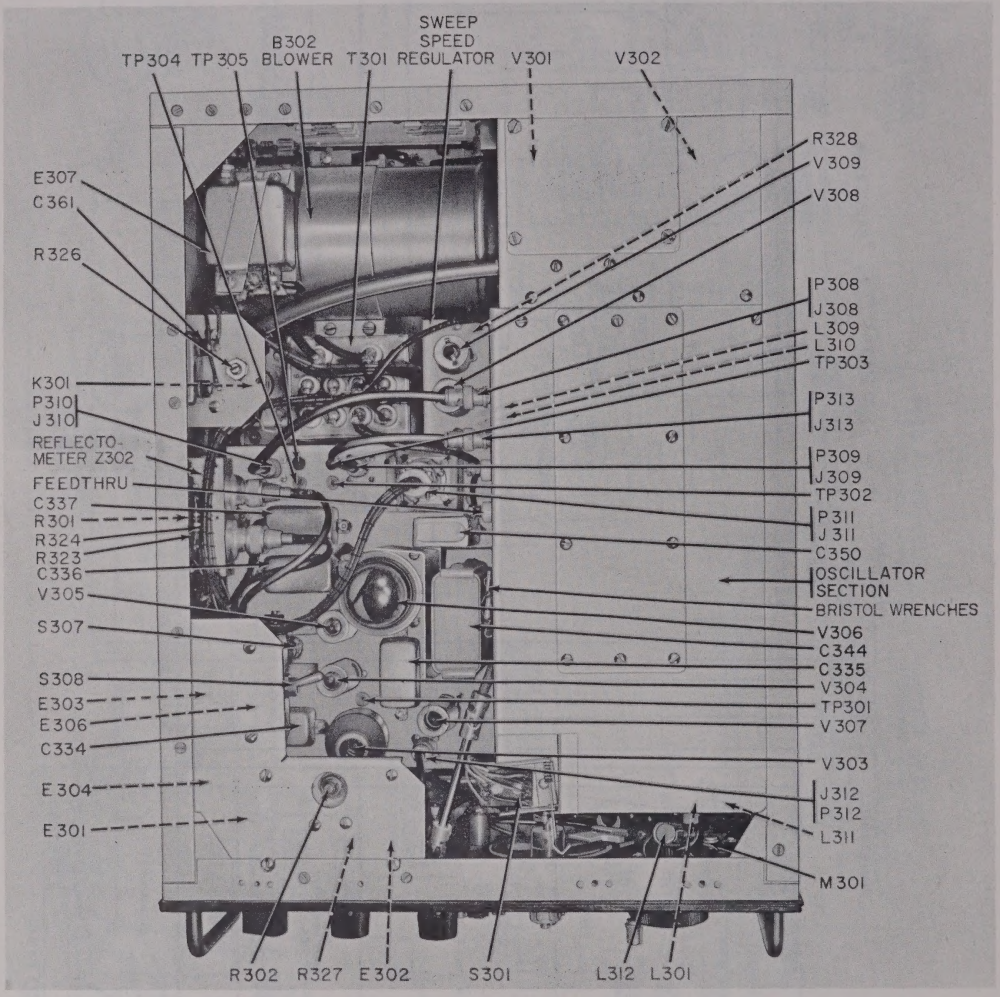


Figure 7-3. Radio Transmitter T-465/ALT-7, Top View.

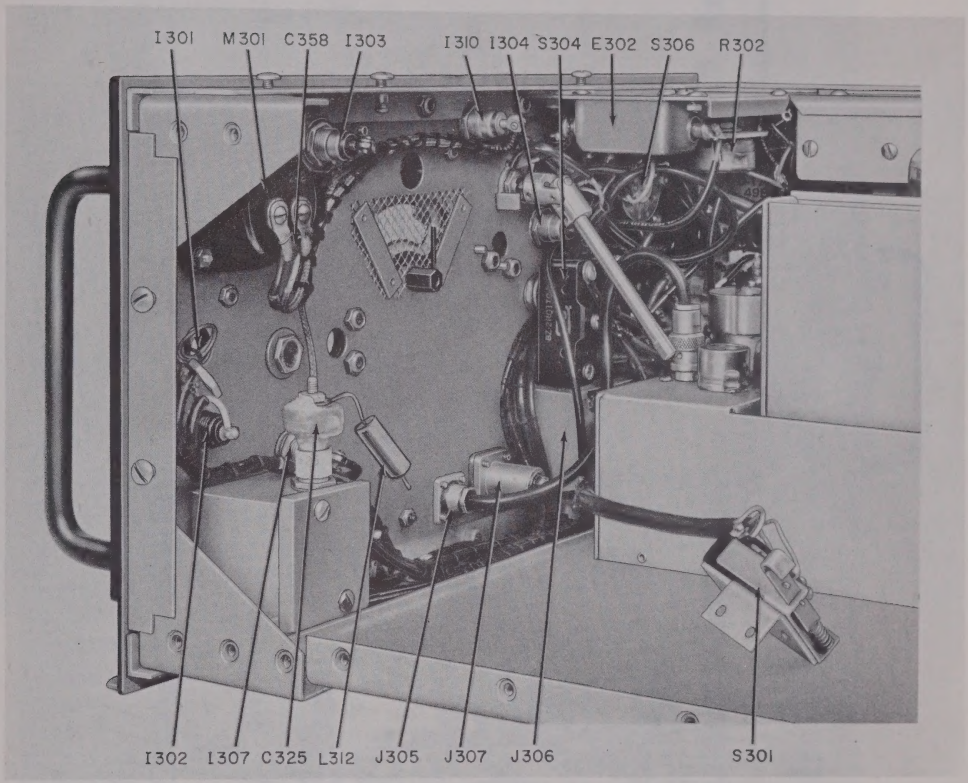


Figure 7-4. Radio Transmitter T-465/ALT-7, Inside Front Panel.

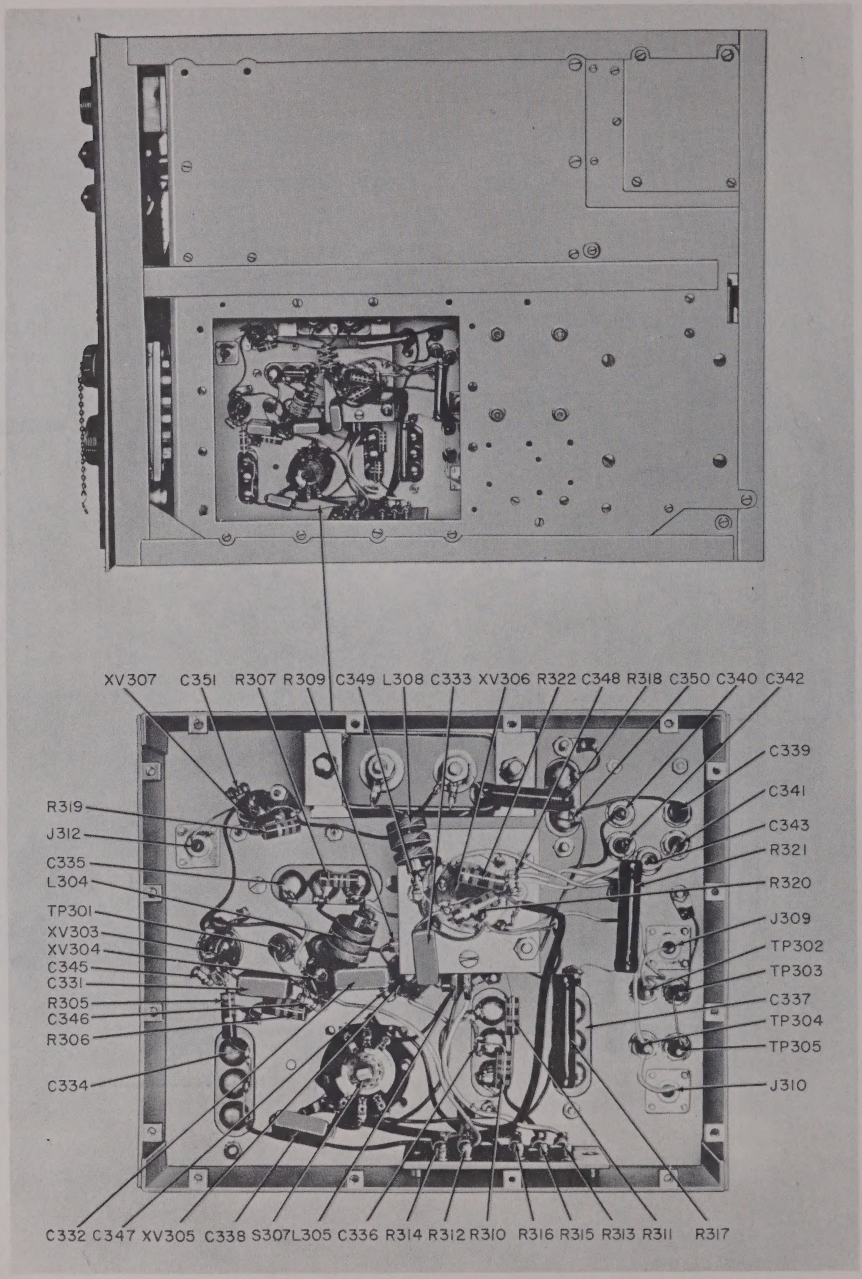


Figure 7-5. Radio Transmitter T-465/ALT-7, Bottom View.

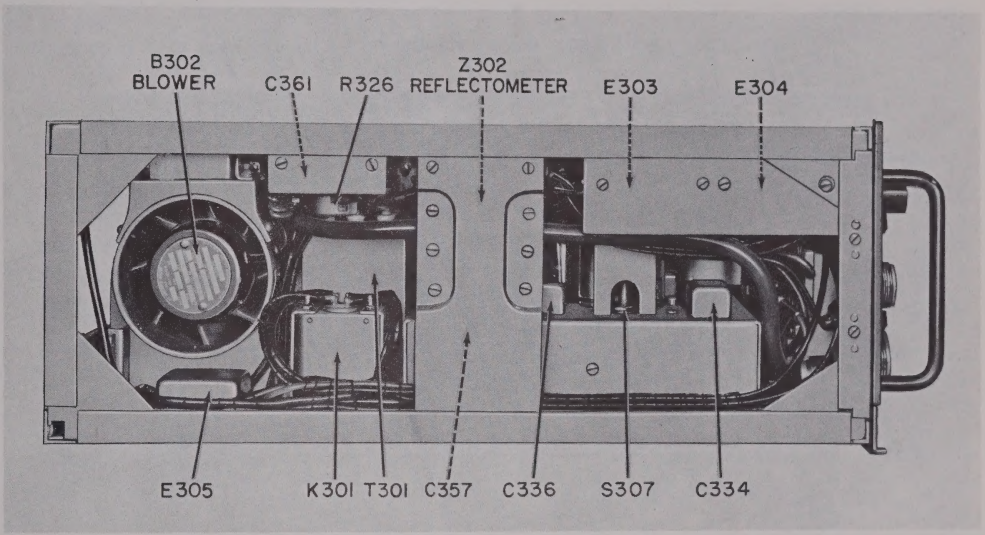


Figure 7-6. Radio Transmitter T-465/ALT-7, Left Side.

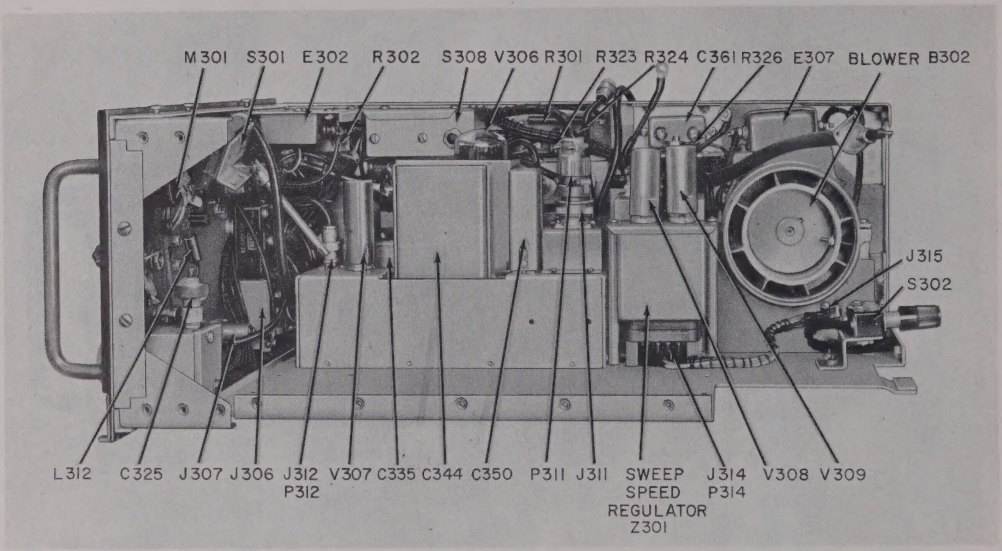


Figure 7-7. Radio Transmitter T-465/ALT-7, Right Side, Oscillator Removed.

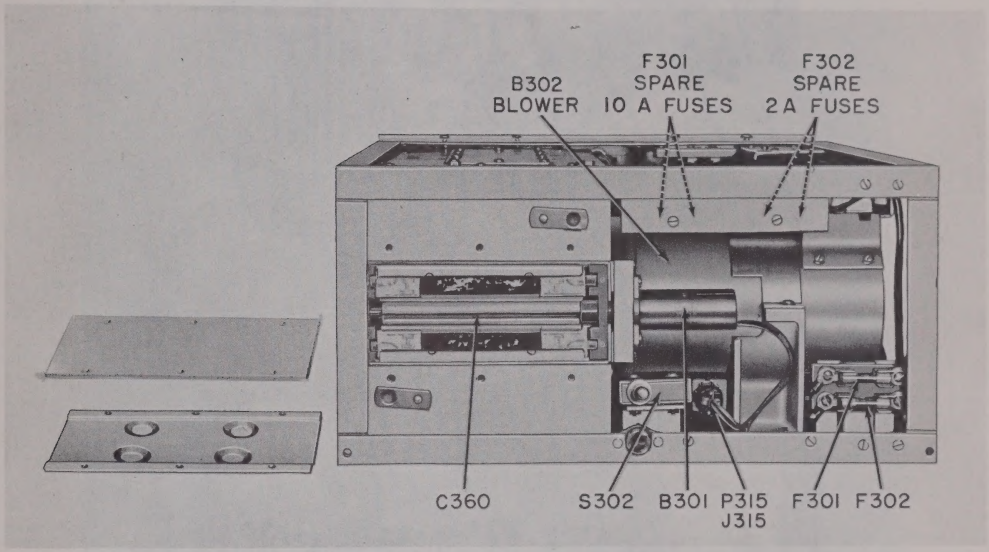


Figure 7-8. Radio Transmitter T-465/ALT-7, Rear View.

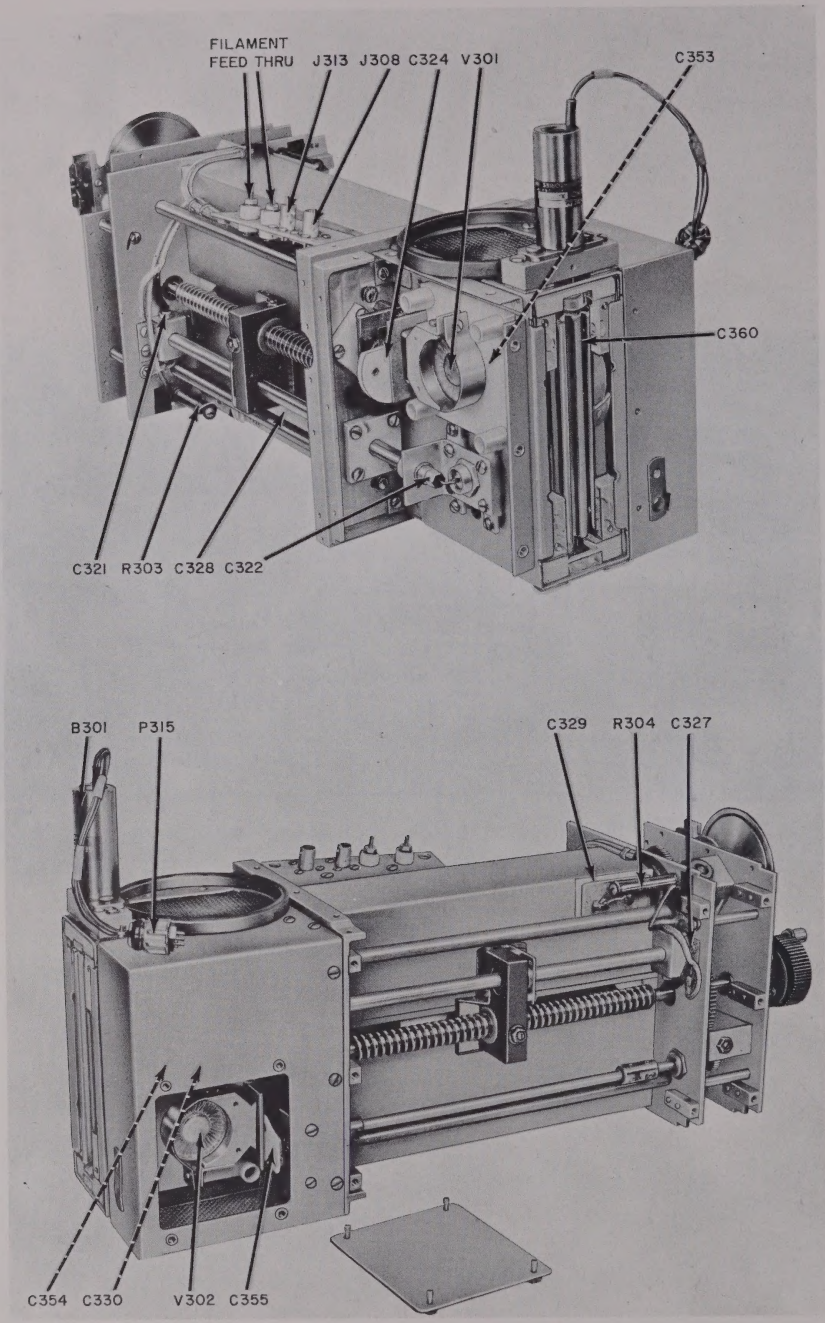


Figure 7-9. Radio Transmitter T-465/ALT-7, Oscillator, Oblique Views.

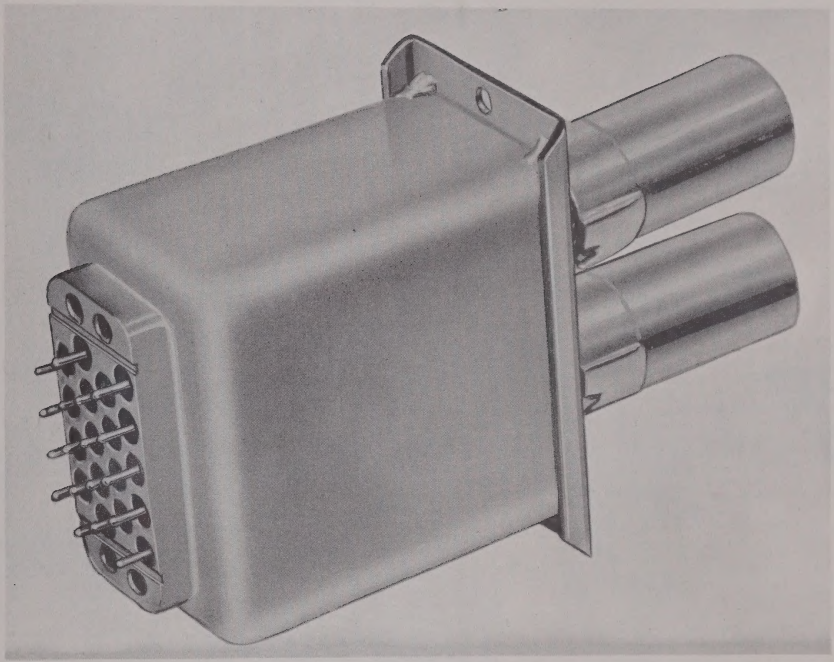
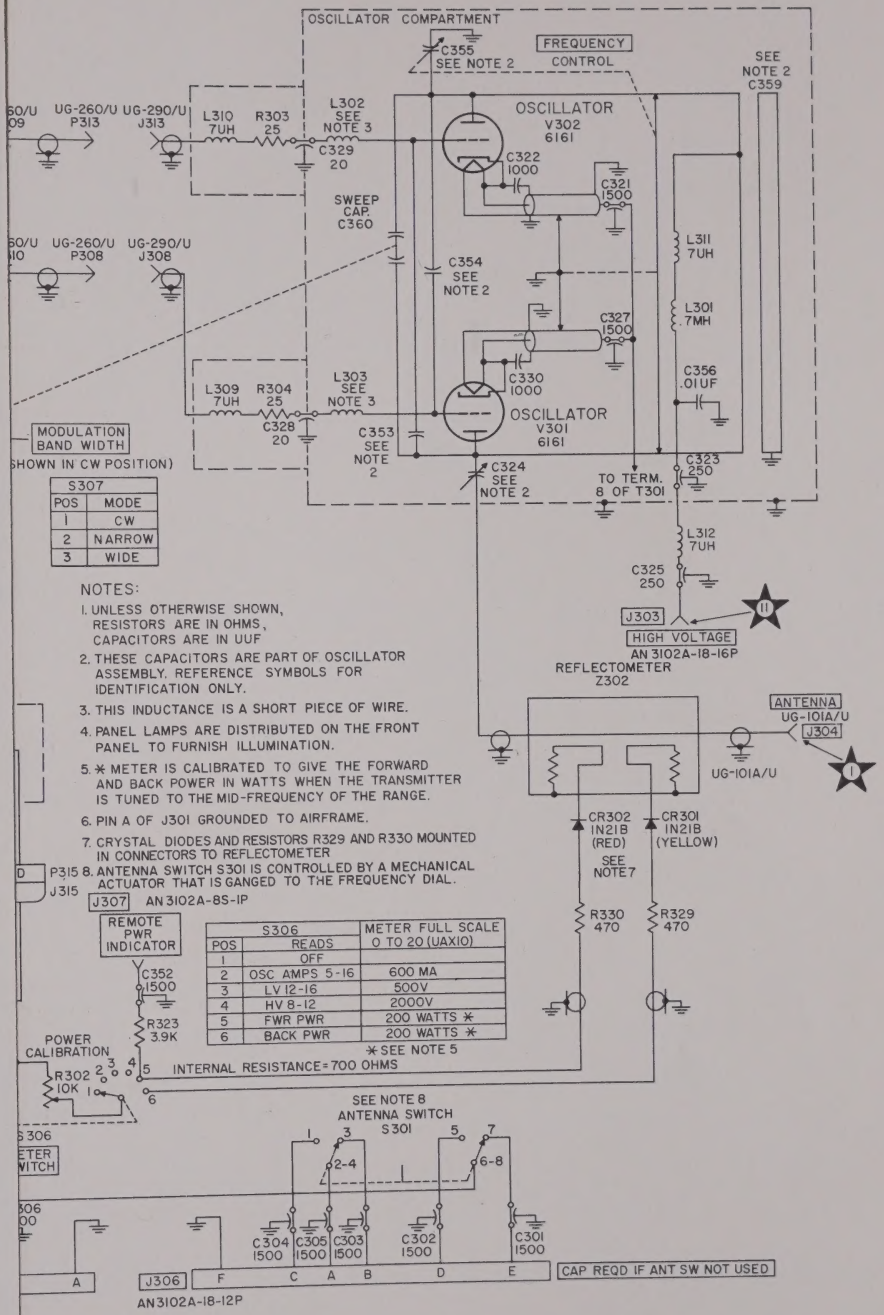


Figure 7-10. Sweep Motor Speed Regulator.



hatic Diagram.

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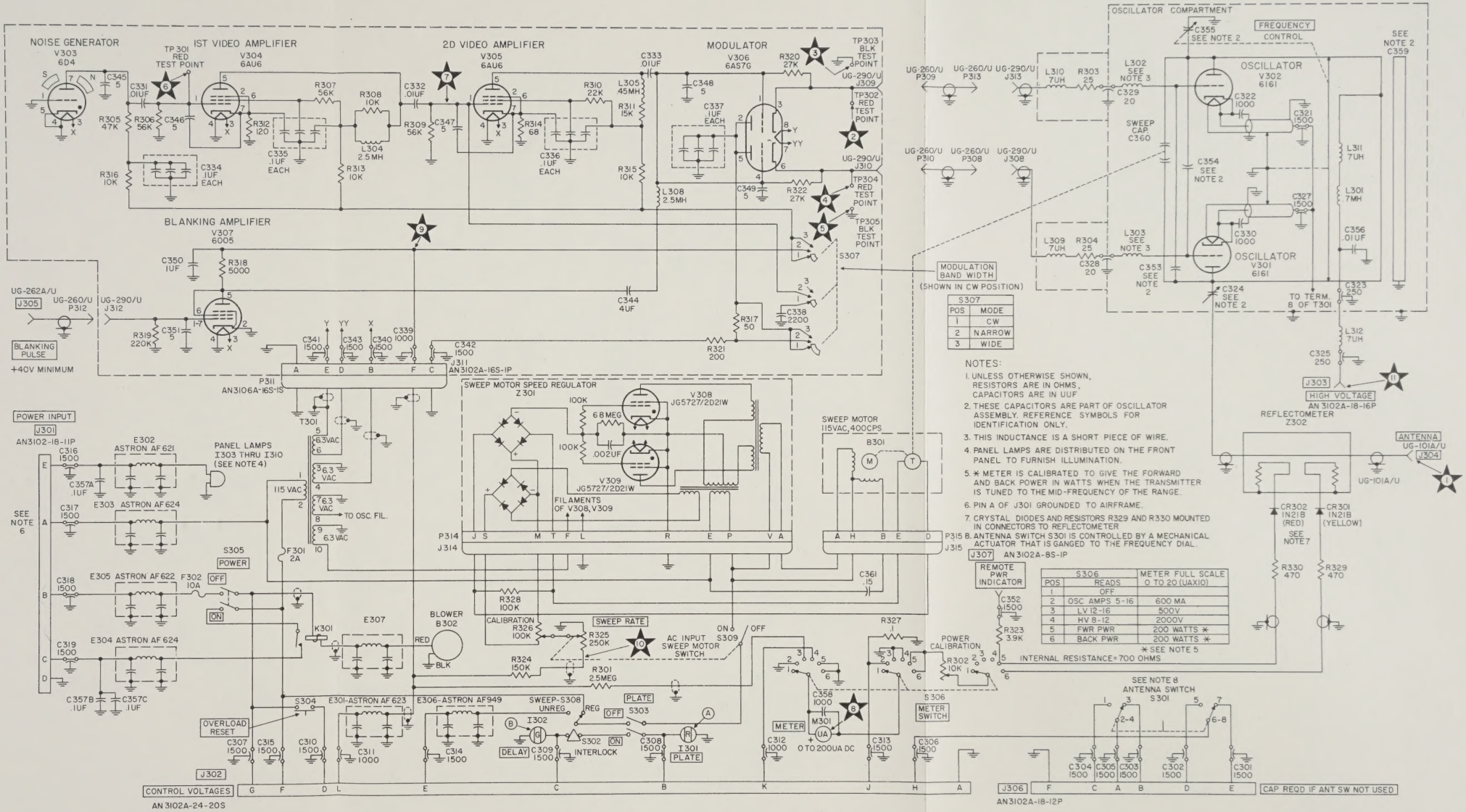

Figure 7-11. Radio Transmitter T-465/ALT-7, Schematic Diagram.

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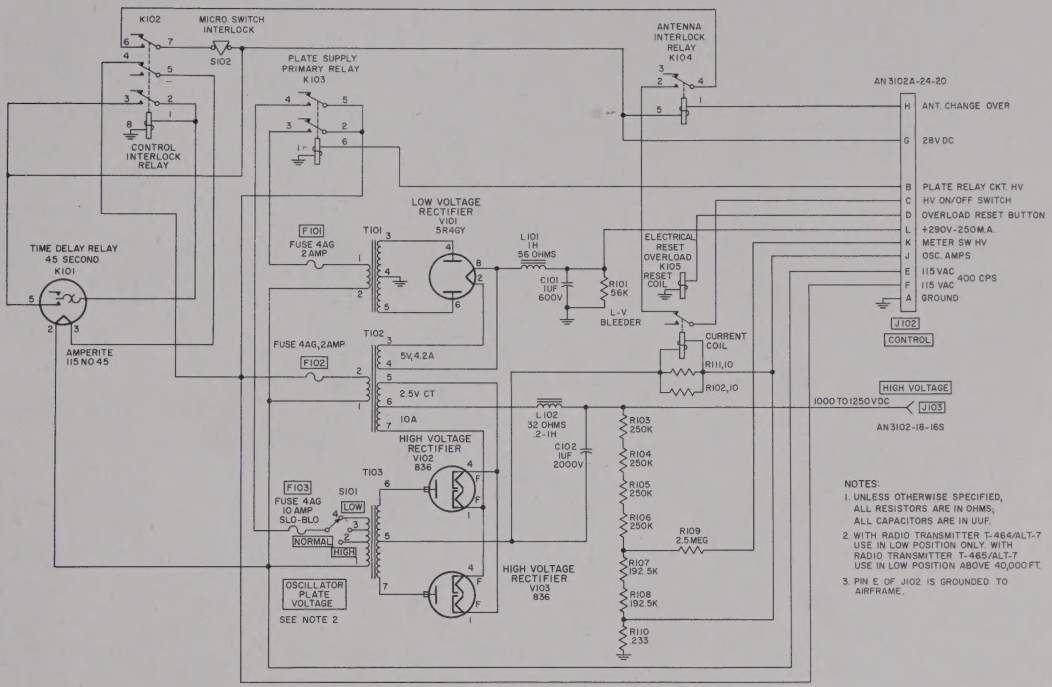

Figure 7-12. Power Supply PP-506/APT-6, Schematic Diagram.

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